Electrical World

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JULY 13, 1940

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Economics — Analysis — Planning — Design — Construction — Operation

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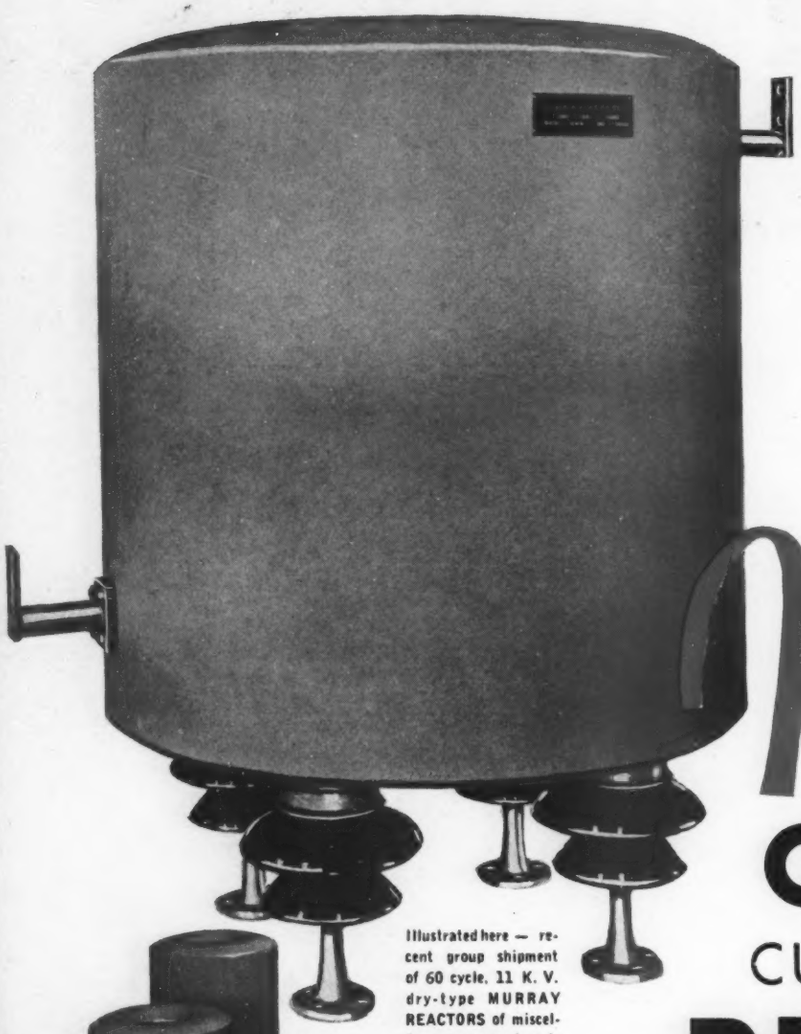

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July 13, 1940

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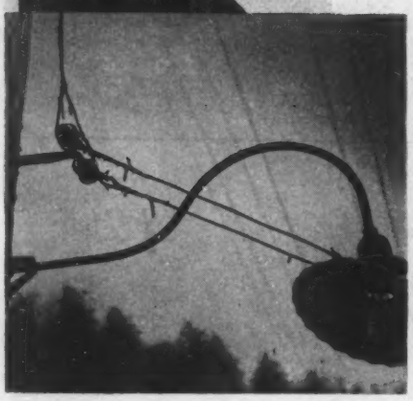
5:30—A STREET LIGHT OUT ON ELM STREET

and service comes on at 6!



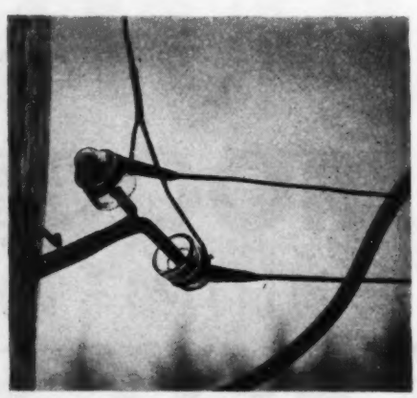
5:35 Maintenance crew arrives — looks over situation. "That reflector is tipped and shorted the service. Guess the kids have been at it again."

5:40 The Jumper clamped in place. By using Servits for the temporary connections the lineman was able to install the jumper in only five minutes.

5:46 One leg of the new conductor has been installed and joined to the lead by a Servit. It's growing dark already, so speed is very essential.

5:48 Just a minute more and the lead from pole will be connected and service restored. A generous guide thread makes it easy to start the Servit nut even with gloves on.

5:49 Service is restored and ready to go. Secure connections made with Servits are a result of high pressure exerted by these low-friction clamps.



5:55 All packed up and ready for the next job. Note workmanlike job of taping—short bolt and smooth-rounded head of the Servit assures a neat connection.

and the job was finished in 20 minutes!

Here is only one case why Burndy Servits are preferred by linemen. For example—an actual poll showed that in one company 75% of the men in the Distribution Department prefer Servits over all other makes of connectors. Engineers select Servits not only because their linemen like them but also because of their forged-in strength — low friction between parts — serrated pressure bar—flat-sided head for easy grip by pliers or wrench—nut retainer (when desired) and host of other practical reasons.

TYPE KS (PAT. RE-ISSUE NO. 20,096)

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BURNDY ENGINEERING CO. INC., 459 East 133rd Street, New York City

Mr. Willkie

Ever since Wendell Willkie received the Republican nomination for president our friends have asked us if the utility people didn't feel pretty good about it, intimating, of course, that if Mr. Willkie were elected everything would be easy sailing once more for the utilities.

We cannot speak for Mr. Willkie. He will have to do that for himself. Furthermore, it has never been our policy to get into political discussions other than appear necessary from time to time to defend the utilities from unfair political attack.

Unquestionably the utility people feel proud that for the first time one of their number has been nominated by a major party for the highest honor this country has to bestow on anybody. What group of people wouldn't? For years the people of the United States have cried out for a business man for president. Cannot the utility men and women be proud that one of their own has been chosen to run for president—not a manufacturer, not a merchant, not a banker, but a utility man?

It isn't the laws that have been enacted that have embarrassed utilities so much as it is the manner in which they have been administered, the way that federal money has been used to destroy values through public competition and the methods used to sabotage utility earning power. The man whom the utility people want to see as president is not one who will attempt to repeal our federal regulatory laws but one who as chief executive of all the people will administer these laws "with malice toward none; with charity for all."

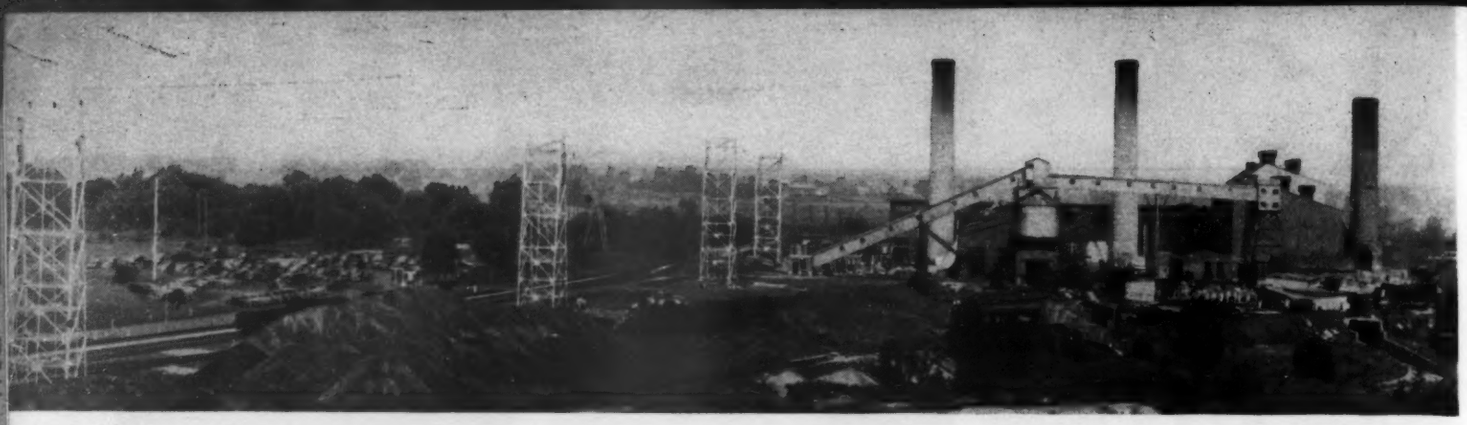
Members of the inner family of the New Deal, members of the public ownership bloc in Congress, members of federal regulatory agencies and local politicians under the stimulus of federal loans and grants have harassed the utilities in every possible way trying to blacken the reputations of power companies in an effort to substitute political for private ownership and operation. Knowing the American public as we do, it is not surprising to find the people turning so spontaneously to the man who almost single handedly has fought these un-American practices. Americans like a fighter and they like fair play.

Mr. Willkie is just as much an advocate of low rates and universal usage of electricity as the most ardent New Dealer. He believes, however, that it is best done by private capital and he has put his faith into deeds. The properties he has managed for the past decade, some of them in below-average income areas, stand at the top of the list for low rates and high residential usage.

He believes in co-operation with government as witness the manner in which Georgia Power has helped REA and helped municipal properties expand customer usage, as witness his proposal for a southern power pool the operation of which would have helped TVA avert many of its headaches.

We mention these as an indication that in matters of national power policy, Mr. Willkie is a progressive liberal and not a stand-patter. There will be no turning back of the clock in matters of national power policy, in our opinion, if Mr. Willkie is elected president.

The kind of liberalism that Mr. Willkie represents should hold no fear for the utility industry because it is founded on the principle of profit—profit for government, for business and for the individual.



REMODELED Walnut station of Columbus & Southern Ohio Electric Company

Topping, Condensing Operation Combined in One Turbine

Superposed unit appeared desirable, but capacity thus provided would not be enough and light load operation would be uneconomical — Combination solved the problem

C. A. BUTLER, JR., United Light & Power Service Company

OPERATION sometimes as a straight condensing unit and at other times as a partial superposition supplying bled steam to older machines states the flexibility of a new 1,250-lb., 37,500-kw. turbo-generator installed in the Walnut station of the Columbus & Southern Ohio Electric Company. To modernize an existing station and to add additional capacity at the same time introduces many special and interesting problems that require a study of the utility system, the available equipment on the market, the nature of load and operating requirements and the relative advantages and disadvantages of several proposals. This was the problem that found solution in such a versatile turbine.

Walnut station is one of the three principal generating points supplying power to a system that includes Columbus, Ohio, and a considerable area mostly to the south of Columbus. The first unit of the station was installed during the first World War. Additional equipment was installed from time to time, so that, just before the addition was made, the principal equipment consisted of 72,000 kw. in turbo-generator capacity, sixteen 444-hp. boilers and four larger 1,035-hp. boilers. Steam conditions were 235 lb. per sq.in. gauge pressure and approximately 580 deg. F. steam temperature in the main headers.

The two other points are the Floodwood station near Nelsonville, Ohio, in the southern district, and Picway, near Columbus, having a capacity of 60,000 kw. in two main units. Prior to modernization of the Walnut station, which is also near Columbus, Picway carried the base load of the system, since it was the newest and most economical station. Picway station was put into service in 1936.

Increased load on the system had made necessary additional generating capacity, and it also made it necessary to generate considerable power at Walnut. Various studies indicated that the most desirable location of additional capacity in the system would be at Walnut, as it would be possible by installing new capacity in that station to improve economy of existing equipment and also to operate the new equipment with the minimum number of additional operators, because a full operating force had to be on duty at Walnut at all times to provide for operating sufficient capacity for standby purposes as well as to operate equipment to take care of peaks in excess of the capacity of Picway.

Another consideration which made it desirable to add the capacity at Walnut was that both Picway and Walnut are so far from Columbus that it is necessary to transmit the power to Columbus by overhead transmission lines. It is therefore conceivable that transmission trouble due to lightning or other causes might temporarily disable one of the stations, but would quite unlikely disable both. Therefore, it would be desirable to have fairly economical capacity at both places.

Topping Unit? Yes and No

Serious consideration was given to installing a topping unit at Walnut. The topping unit, however, would require operation of a condensing turbine unit along with it, hence the two units operating under night load conditions would show quite poor economy. It was not desired to shut down Picway at night, and this fact aggravated the light load operation in the topping turbine proposal.

Furthermore, the maximum size of a topping turbine which could be operated economically, together with the necessary condensing units under the daytime load, was 15,000 kw., and this amount of additional capacity was not sufficient to meet the requirements of the system.

It was therefore felt that the proper installation was a condensing turbine so that it could be operated alone under light load conditions.

Consideration of available circulating water made it desirable to keep the amount of steam to be condensed in the plant as low as practical. This fact, together with the comparatively high price of fuel and the fact that the new equipment could be operated at a comparatively high load factor, made it desirable to use as high steam temperature and pressure as could be considered to be past the experimental stage.

Use of the high temperature and pressure, of course, made the inherent advantages of a topping turbine in improving the economy of the existing 250-lb. equipment very desirable, but, as mentioned above, other considerations had practically ruled out considerations of a topping turbine. Investigation was therefore started with the larger turbine manufacturers to determine whether or not it would be practical to construct a turbine which would embody the advantages of the condensing turbine and the topping turbine as well. The way in which these advantages were to be combined was to provide for as much steam extraction as possible from the new turbine at 250 lb. per sq.in. gauge, this steam to be delivered to the existing 250-lb. steam header for use in any of the existing turbines.

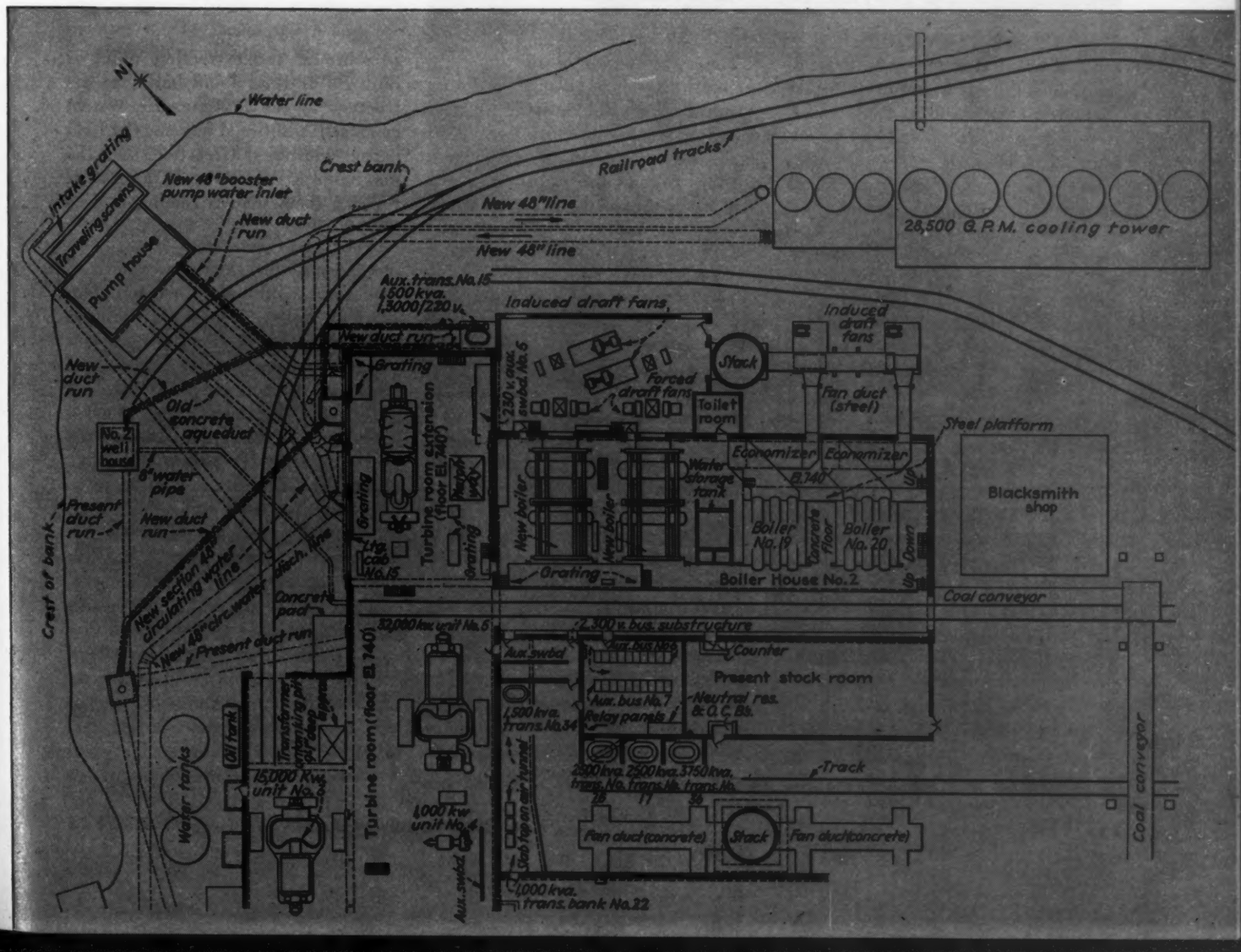
Furthermore, the existing turbines in Walnut had no provisions whatsoever for extracting steam for feedwater heating. It was desirable, therefore, to provide the extraction openings for the feedwater heating in the new turbine of sufficient capacity so that all of the feedwater to be evaporated in the high-pressure boilers could be heated by steam extracted from the new unit.

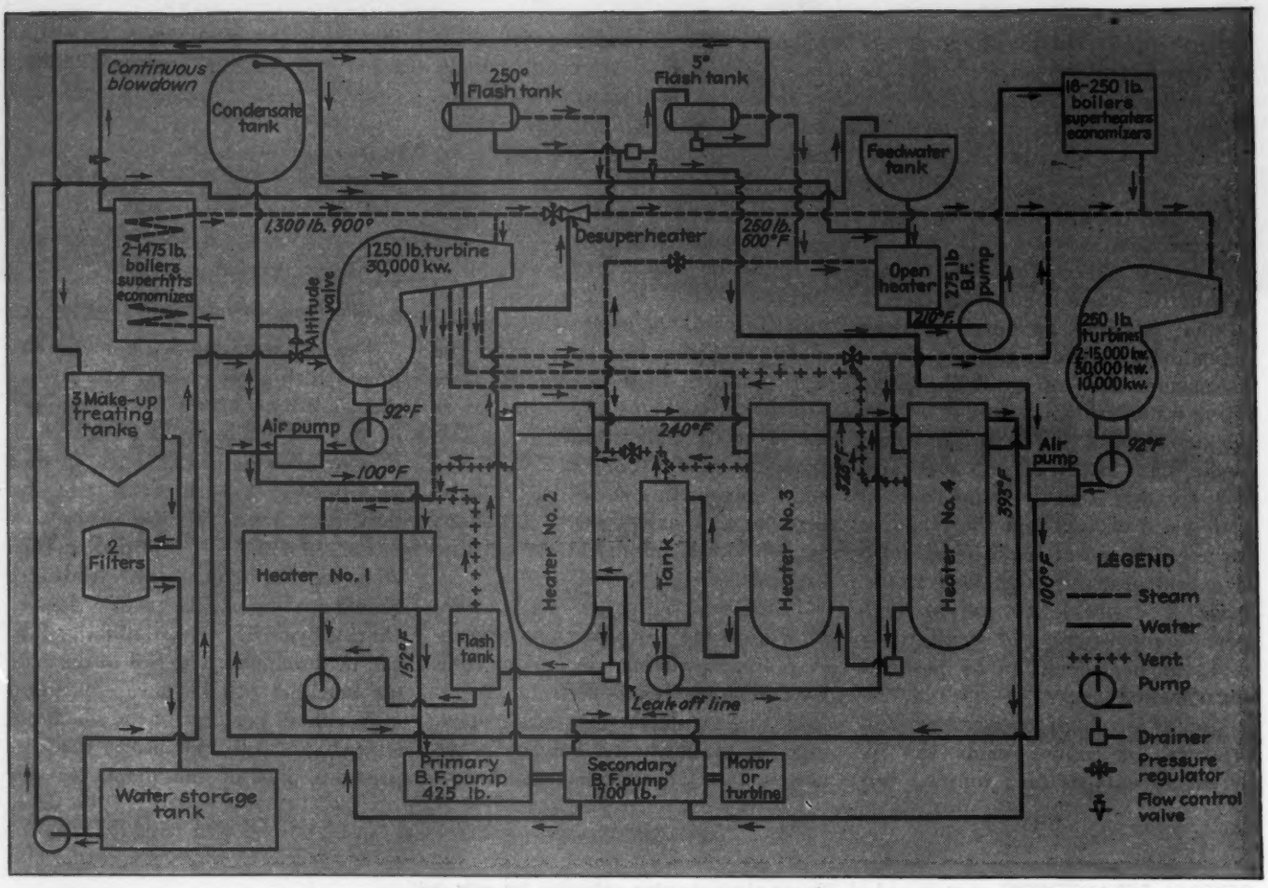
It was found that the proposed arrangements were entirely practical and, therefore, the turbine was specified to include the special features desired.

Turbine Generator Operation

The unit installed is a tandem-compound turbine connected to a hydrogen-cooled generator and was built by the Westinghouse Electric & Manufacturing Company. This turbine will operate a part of the time on the regenerative cycle with steam conditions of 1,250 lb., 900 deg. F.T.T., 28.5 in. vacuum, with feedwater heated in four stages to 395 deg. F. On this cycle 37,500 kw. at unity P.F. can be developed. The rest of the time the machine will be a superposition unit with 49 per cent of the steam extracted at 250 lb., for use in the low-pressure part of the plant, 27 per

GENERAL ARRANGEMENT at north end of Walnut plant showing extension for new unit

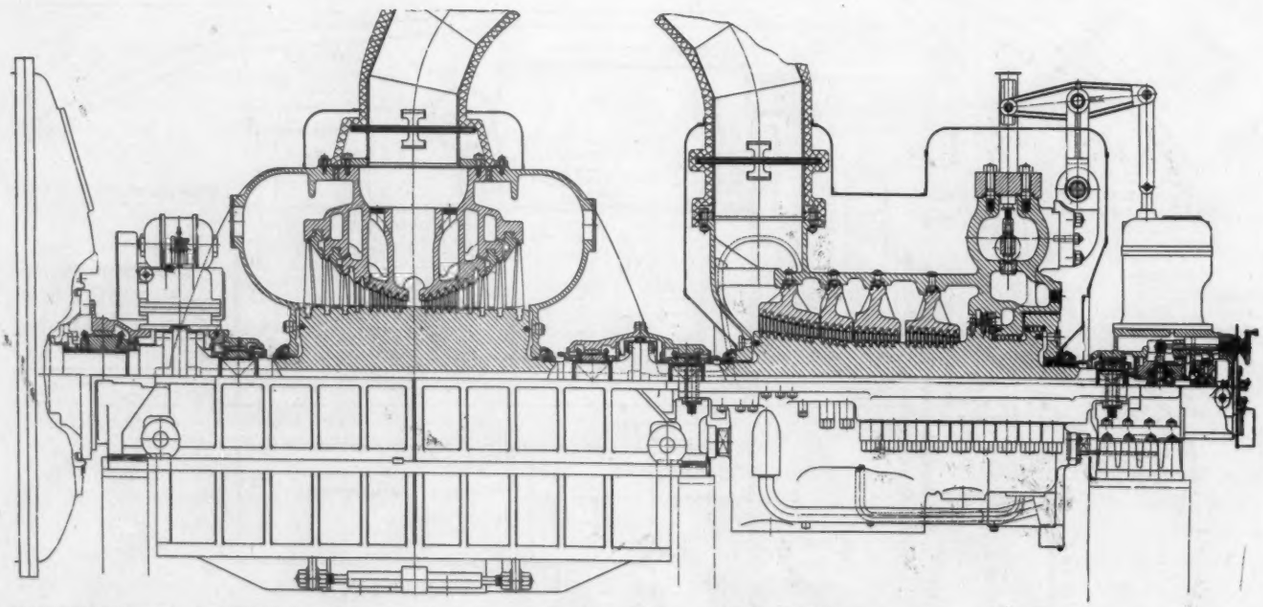




SIMPLIFIED steam and water flow diagram for Walnut station

cent extracted at four points for heating the combined feedwater and only 25 per cent passing to the condenser. It will be seen that the addition combines 30,000 kw. of firm power with the rehabilitation of an existing unit of equal size.

The combination of the new and the existing unit is arranged with the simplest of control devices. No grid valves or secondary control valves of any kind are used. An extraction opening follows the eighth stage, so that when the load is increased the pressure at the extraction point is built up until at about half load extraction to the low-pressure system can start. Additional increases of load permit additional extraction, until the maximum is reached at 30,000 kw. It follows, then, that extraction is gov-



CROSS-SECTION of 30,000-kw., 3,600-r.p.m. tandem condensing turbine at Walnut station

erned by the usual processes of load control. While operating non-extracting the first stages have a very considerable excess capacity. To prevent overloads, an adjustable latch known as a load-limit device is arranged in the governing system. With this, by the turning of a knurled knob, the steam chest opening is limited to any predetermined amount. The same device can also be used for base-load control at any load. The governor is arranged so that other special controls can be built into it, if the complexities of operation are found to require them, but at present it is not believed that they will be needed.

Independent Elements

The high- and low-pressure elements of the turbine have been kept independent of each other as much as possible, the dividing line closely corresponding to the saturation line. Consequently, the high-pressure, high-temperature section is characterized by small diameters and low stresses which favor the design of a relatively simple cylinder structure with provisions for even heating and uniform expansion. The 1,250-lb. pressure is limited to the relatively small cavities of the steam chest and the heating belt extending to the base. No bypassing of any stage is employed, so that the cylinder walls along the reaction blading are proportioned for progressively lower pressures and temperatures. Separate rings, supported at the vertical and horizontal centerlines and free to expand outward in all directions, carry the stationary reaction blading and help to maintain the minimum tip clearances required by central station practice.

The gaps between the blade rings lead to flanged openings in the cylinder base, through which the unusually large amounts of extracted steam are conducted. Five extraction openings are provided in the high-pressure cylinder and one in the low, giving opportunity for future variation in the cycle. The materials used throughout the high-pressure element are suitable alloys of chromium, molybdenum and tungsten.

While the rating of the unit is within the capacity limits of 3,600 r.p.m. air-cooled generators, it was decided to take advantage of the higher efficiencies of the hydrogen-cooled generator. This eliminates air ducts in the foundation as the hydrogen coolers are built into the explosion-proof frame of the generator. This simplification is somewhat discounted by the added shaft sealing features and the hydrogen control apparatus.

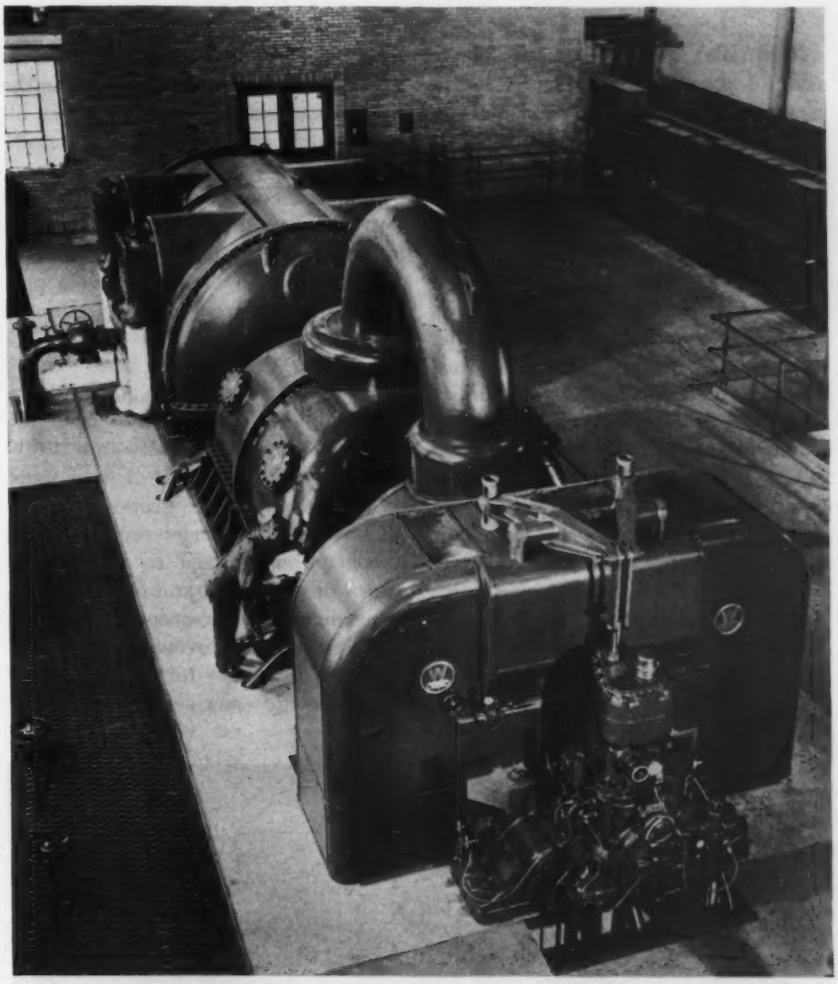
In order to obtain greatest value from the extremely flexible turbine unit it was necessary to provide for corresponding flexibility in the steam generating equipment. Several considerations made it desirable to install the required steam-generating capacity in two boiler units rather than in one large boiler unit.

First, the new turbo-generator naturally could not be operated with steam from the 250-lb. boilers and, therefore, it was desirable to have two high-pressure boilers to minimize possibility of decreased turbine availability due to boiler room trouble.

Second, the new steam-generating equipment is enough more efficient than the existing equipment so that it can be economically operated in connection with the old turbo-generators by passing the steam through proper reducing valves and desuperheaters. This makes it desirable to have at least part of the high-pressure steam-generating equipment available at all times.

Third, the relation between the steam required by the turbine when extracting maximum amounts of steam for feedwater heating and for use in the low-pressure turbines to the steam required by the new turbine when extracting steam for heating its own condensate only was found to be such proportion that a very desirable two-boiler installation could be made. Each of the boilers in this installation was designed to supply normally half of the steam required under the first-mentioned condition and also was arranged so that sufficient maximum steaming capacity could be provided to enable

[*Continued on page 59*]



NEW 30,000-KW. tandem turbo-generator and auxiliary distribution center at Walnut

KEEPING DOWN COSTS FOR

W. J. LYMAN, Duquesne Light Company, Pittsburgh, Pa.*

PROBABLY between 20 and 30 per cent of the entire investment in the electric utility industry is devoted primarily to service continuity and its improvement. This estimate covers spare capacity and the provision of such protective equipment as circuit breakers, fuses, relaying supervising control, etc. In this field a challenge is presented to continue the attack on the elusive problem of attaining requisite service continuity with least possible outlay. Highest reliability per dollar is the goal.

The problem becomes more pressing and more difficult of solution as equipment, *per se*, is steadily made more reliable because provision of proper reserves is thereby progressively more difficult to compute and justify. It is proposed that the problem will be simplified somewhat if the cost of service can be expressed in terms of the percentage increase in the total annual cost of power for each 50 per cent reduction in total interruption time.

Another contributing factor toward lowered investment for given quality of service is the proper co-ordination of reliability in each component part of the system from power station to customer.

Two Types of Problems

Problems of this nature seem to fall into two classes:

1. Customers or groups of customers already being served, but with interruptions judged to be too frequent or prolonged and for whom improvements are in order.

2. System improvements or extensions to be made for reasons other than specific service improvement, but which may and usually do have some effect on customer interruptions.

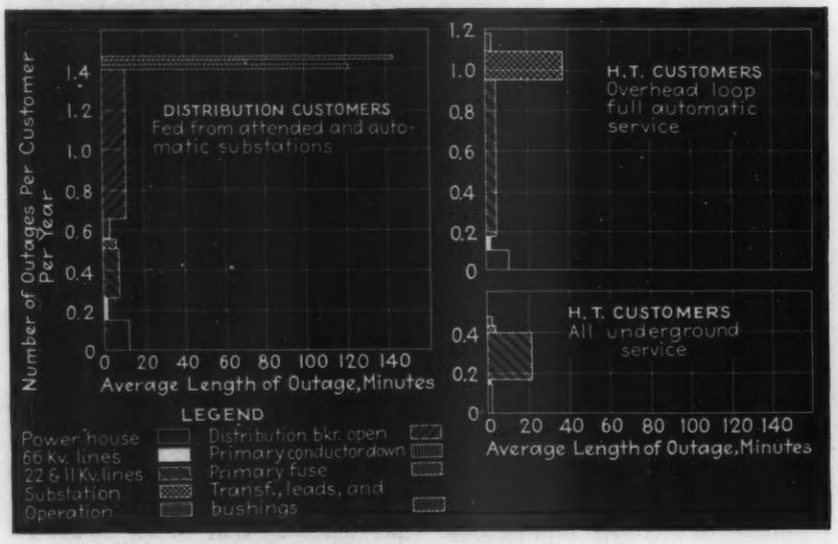
Frequently one of the alternative procedures in the second type of cases is sufficiently different from the others to affect service continuity to a considerable degree. It is much easier to make an intelligent choice if it is possible to state approximately what the average frequency and duration of customer interruption from all causes will be for each scheme proposed. Next, it is desirable to have a basis for determining how much may reasonably be spent specifically for each alternative to effect the desired service continuity. The evaluation involves elements all the way from concretely determinable costs and benefits to the intangible matters of policy. However, the fewer the items to which no definite dollar value can be ascribed the greater the certainty of an economic decision.

Reserves vs. Improved Equipment

It became evident at an early date that service continuity could be improved in two ways—by providing reserve units to use during breakdowns and by improving equipment so that failures would be less frequent. It was recognized that a reasonable expenditure for improved service would pay in the long run and both methods were applied. The relatively high quality of service continuity now being generally furnished, together with the further improvement in equipment performance almost certain to come about through developments in the art, will raise queries whether reserves are justified in certain places where they are now taken for granted.

As long as reserve capacity is necessary to take care of breakdowns it is not difficult to secure equipment outages in order to do the required

*Electrical planning engineer.



CUSTOMER service interruptions segregated

Ordinates are outages per customer per year, while abscissas are minutes per outage. Areas are thus minutes per customer per year and are proportional to the average annual outage time. Thus a five-minute shut-down of all power plants is equivalent in service lost to five-minute outages to all distribution circuits or all transmission lines and will appear the same size on the diagram

SERVICE CONTINUITY

Least investment for acceptable service obtained by co-ordination of reliabilities and by comparing decreases in interruption time on a percentage reduction basis

maintenance work. If the percentage of reserve is reduced as the equipment becomes more reliable, more of the maintenance work must be done at offpeak periods. In some cases this may be difficult and result in somewhat higher costs. This increase, however, would not seriously detract from the capital savings resulting from the reduced reserve. Fixed charges may be fifteen times as great as the portion of the maintenance costs affected by increased loading.

Maintenance requirements, nevertheless, will become an increasingly important factor affecting system planning and more complete records of maintenance outage requirements will in many cases be a definite aid to the planning engineer. Further co-ordination of maintenance work on related pieces of equipment may be necessary in order to do the work in the time available. Naturally, maintenance standards should not be reduced, since the improved equipment reliability is due in a large measure to an adequate maintenance program.

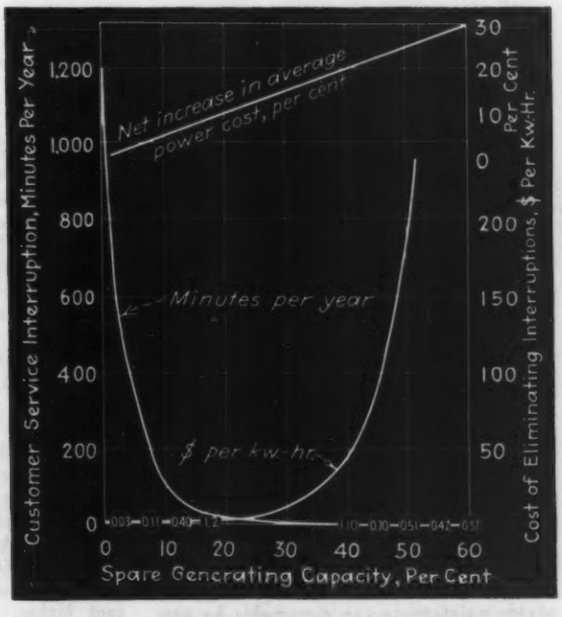
Method of Approach

The first step is to find out just how many outages the different classes of customers are having and what is causing them. It is surprising how many service continuity problems practically "solve themselves" when the experience data on equipment performance and customer interruptions are available. However, where new schemes are being considered for which experience data are not available, it may be necessary to calculate the probabilities of certain occurrences based on known facts. In either event, an analysis of the basic data is necessary.

The graph of "customer service interruptions segregated" illustrates an analysis of customer outages and shows the responsibility of each part of the system. This same type of diagram appeared in 1933 in a paper by S. M. Dean of the Detroit Edison Company. This gives a clear picture of the nature and causes of outages.

Coordination of Reliability

Such a study of service outages will show where the troubles occur and raises the question of whether some sections are not too reliable and others unnecessarily poor. By directing efforts to the weak links, as measured in terms of ultimate service to the customer, investment can be kept to a minimum. It is not unusual to find that the troubles which seem most prominent and receive the greatest attention are not causing as many customer interruptions as might be expected. For example, the same graph shows that the 66-kv. lines which form the backbone of the system and trip out rather frequently due to lightning are responsible, on an average, for only a one-minute interruption to each customer every six years. This is due to the use of duplicate feed with very effective relay protection. Modernizing these circuits would reduce the number of flashovers, but would not greatly improve service continuity and could be justified only by other advantages such as reduction in voltage dips or by increases in load where the need for additional circuits could be eliminated by increasing the reliability of existing lines. Savings in maintenance costs must also be considered, but they are a relatively small factor.

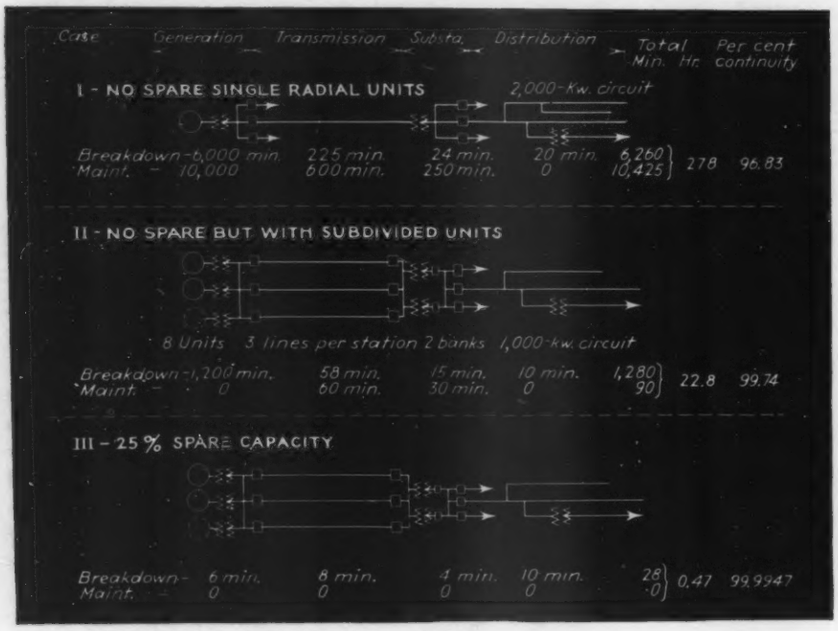


It will be seen that with no spare capacity the load will be interrupted an average of 1,200 minutes per year, assuming that the seasonal drop in load is used for inspection and maintenance. The addition of 10 per cent spare, however, reduces the outage time to 100 minutes, a gain of 1,100 minutes. Another 10 per cent spare reduces the outage time to 15 minutes and the gain has been cut to 85 minutes. The third 10 per cent spare saves only 11.5 minutes and the next 10 per cent step only 2.4 minutes. The encircled values on the curves are for points too small to infer from the scales of interruption minutes and dollars per kilowatt-hour. The curve at the top shows the net increase in average power cost, taking into account the operating savings made possible by the added capacity, which would presumably be more efficient than some of the existing generators.

COST OF SERVICE improvement by spare generating capacity

When studying data such as on the graph of service interruptions it must not be concluded that a relatively large proportion of the interruptions being caused by one part of the system is the result of poor planning. Some classes of equipment are more susceptible to trouble than others and an attempt to equalize their reliability would be uneconomical. It would be unwise at the present stage of the development to attempt, for example, to make distribution circuits as reliable as the power station. *From a mathematical standpoint, the ideal distribution of investment results when the incremental cost of reducing outages a given amount is the same for each part of the system.*

It would be of considerable value both for general system planning and also in the consideration of individual cases to have some numerical measure for the cost of service continuity. Suppose, for example, that it is desired to improve service to customers in a suburban area supplied from a substation looped through non-automatic switches to a high-tension line. Estimates might show that improved lightning protection on the distribution transformers would cost $5 per kva. of load and would, based on experience elsewhere on the system, reduce interruption time an average of ten minutes per year (this might be 60 minutes to one-sixth of the customers each year). At 15 per cent carrying charge this would be 7.5 cents per kva. per minute of reduced outage. An alternate scheme, however, might be to apply automatic service-restoring equipment in the substation for $3 per kva., which would reduce the interruption time fifteen minutes per year—a unit cost of 3 cents per kva. per minute.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2,000-Kw. circuit
Breakdown - 6,000 min. 225 min. 24 min. 20 min. 6,260
Maint. - 10,000 600 min. 250 min. 0 10,425
278 96.83
II - NO SPARE BUT WITH SUBDIVIDED UNITS
8 Units 3 lines per station 2 banks 1,000-kw. circuit
Breakdown - 1,200 min. 58 min. 15 min. 10 min. 1,280
Maint. - 0 60 min. 30 min. 0 90
22.8 99.74
III - 25 % SPARE CAPACITY
Breakdown - 6 min. 8 min. 4 min. 10 min. 28
Maint. - 0 0 0 0 0
0.47 99.9947

EFFECT OF spare capacity on service continuity

Case I illustrates a system with no spare whatever and straight radial feed. Obviously, when the generator breaks down, every customer has an outage, and the failure of any piece of equipment means customer interruptions. Likewise, outages are necessary to perform maintenance (except on the low-voltage distribution system). The net result is seen to be a total outage duration of 278 hours per year. Thus a system which has a minimum investment will render service about 96.8 per cent of the time, which is obviously inadequate for electric service.

Case II shows the first step in improving service continuity. Adding more capacity to the units in Case I would be useless, but by subdividing the units into multiple paths, with the same total capacity, a failure at one point does not shut down the whole system. Since the loads are less than the peaks most of the time, it will be found that many breakdowns will not cause any interruptions. A generator breakdown will only interrupt a portion of the customers and then only during the peak hours. Generator maintenance can presumably be performed during the seasonal load dip.

The net result is a reduction from 278 hours to 22.8 hours, or a saving of 255.2 hours per year. Although the capacity has not been increased, the investment has been raised 20 per cent or 25 per cent by the use of smaller units, more switching facilities and a more expensive relay system. An increase of 2.9 per cent in service continuity has increased the cost of power about 15 per cent (total costs not directly proportional to investment). Although these few extra killowatt-hours have cost five times as much as the average, the results justify the effort.

Case III shows the further improvement which may be obtained by adding 25 per cent spare, except in the distribution system, where the performance is already quite satisfactory. The 1,200 minutes outage time caused by generator trouble has dropped to only six minutes. The total time is now only 28 minutes, a reduction of about 22.3 hours per year.

This 25 per cent added capacity will not cost 25 per cent extra, since in many cases it means larger units or perhaps only larger conductors, but the investment would increase perhaps 15 per cent and the cost of power would probably be about 10 per cent higher. The numerical improvement in service has been only 0.25 per cent and the cost of the added kilowatt-hours is about 40 times the average power cost of the system.

Tangible Comparisons

This hypothetical case has been cited merely as a suggestion of how comparisons might be made more tangible. This line of reasoning suggests a statement of the actual cost of the energy delivered by virtue of the new equipment. In the case of the service-restoring scheme the cost is 3 cents $\times$ 60 = $1.80 per kva. per hour of reduced outage time, and if the average load (weighted in accordance with the periods when trouble normally occurs) is 0.5 kw. per kva. of peak, the additional energy delivered costs $\frac{1.80}{0.5} = \$3.60$ per kilowatt-hour. This may sound like expensive energy, but it would not be difficult to find actual cases where the unit costs run much higher. Probably the best manner of judging whether or not such a figure is out of line is to compare it with similar figures from the existing system. Many difficult problems have been solved through the trial-and-error method and have been proved by experience. This frequently furnishes a basis for comparison and every improvement thereon is a step in the right direction.

Expression of service improvement in $/kw.-hr. has certain uses and is a valuable concept, but obviously must be used cautiously. The overall increase in cost of power at the customer's meter is the important measure. In the case just cited, although the emergency power costs $3.60/kw.-hr., there is such a small amount of it involved that the net annual increase in cost of service is only about $\frac{1}{2}$ per cent.

A true measure of service interruption must, of course, consider not only total minutes per year but also the number of outages per year and perhaps the time of day. In practice, however, minutes per year is usually a fair criterion and is easier to work with.

Diminishing Returns Evidenced

Efforts to reduce outage time follow the "law of diminishing returns." The first steps make drastic reductions at a moderate cost, but each succeeding step becomes more expensive, soon reaching excessively high figures. In practice it is, of course, necessary to credit each addition with any savings in operating cost which it may produce before figuring the cost of service continuity.

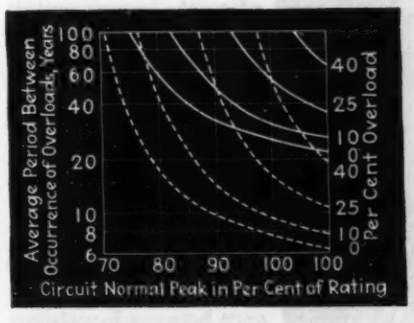
This condition is illustrated by an analysis of generator reserve shown in an accompanying graph. Beyond a reasonable point improvements are unduly expensive. Other parts of the system behave in a similar manner. Service improvement through the use of higher grade equipment (such as bigger poles, over-insulation, improved relaying, etc.) must also be viewed in the same light.

The salient features of this whole problem have been summarized and brought together in the diagram for effect of spare capacity on service continuity. It shows a simplified system with generation, transmission, step-down substation and distribution and illustrates how each element contributes to the customer outages and how good service can be rendered. This analysis provides for maintenance outages as well as breakdowns. The figures are based on experience and are believed to be a fair representation of actual practice.

Case I shows that a system with no reserve and with the capacity all in single large units would subject the customers to a total outage duration of 278 hours per year. By simply subdividing the units of capacity as shown in Case II without adding any reserve, the interruption time is reduced to 22.8 hours per year.

Case III illustrates that by adding 25 per cent reserve the interruption time would be further reduced to only 28 minutes per year. The increasing cost of the additional energy supplied through service improvement is clearly shown.

There is no doubt that, in general, the two steps in service improvement detailed in the graph of the cost of service improvement by spare generating capacity have been justified and that the customers have been willing to pay the additional 25 per cent to avoid troublesome outages that originally amounted to over twelve days per year.

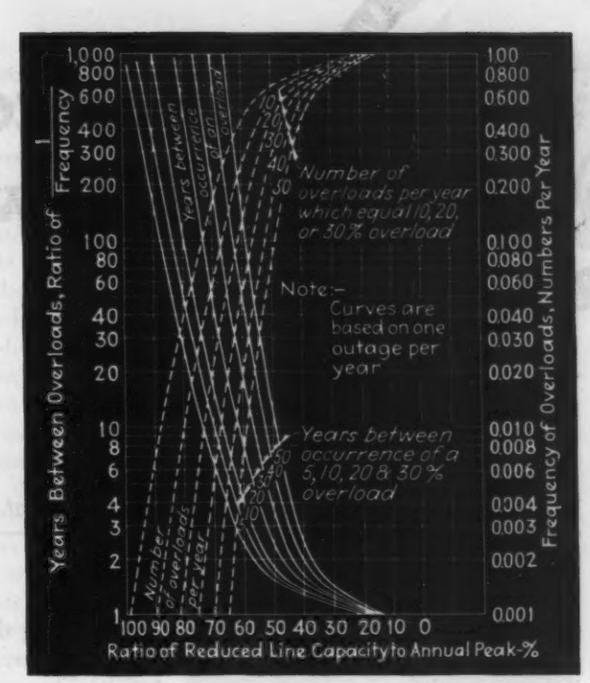


PROBABILITY of distribution circuit overloads from use of emergency ties

Based on: Each circuit out once in two years, each circuit with emergency ties to two other circuits, normal seasonal distribution of outages.

Dotted curves show results considering all outages lengthy enough to use ties. Since only 30 per cent of the outages last more than ten minutes, the solid curves based on this fact should be used.

Example—With normal circuit peak at 100 per cent of rating, overloads of 25 per cent or more would occur on an average once in 54 years.



Consider, for example, a substation with an annual peak of 25,000 kva. supplied from three circuits rated 10,000 kva. each. Experience shows that about five tripouts a year may be expected. The lines follow different routes and with one out of service the effective combined rating of the two others is 18,000 kva. because of unequal loading. This is 72 per cent of the annual peak and reference to the curves shows that normal rating will be exceeded 0.12x5= 0.6 times per year. A 20 per cent or greater overload will occur 0.0125x5= 0.0625 times per year or once every sixteen years. If there happened to be sixteen substations on the system similar to this, then one line overload of 20 per cent or more would be expected each year. The theoretical maximum overload would be 39 per cent $\left(\frac{100-72}{72}\right)$ but 30 per cent would be exceeded only 0.003x5=0.015 times per year per station. The duration of the overload would range from a minute or less if the line returns to service to several hours if a severe breakdown should occur at the beginning of the peak-load period.

LINE OUTAGES on 22 kv. and frequency of circuit overloads, based on one outage per year

Proportional Reduction Basis

Another means of measuring service improvement is on a "proportional reduction" basis. Consider a group of rural customers where a total outage time of two hours per year is normal as compared with a commercial district where the interruptions average twenty minutes per year from all causes. Both groups, due to their inherently different power requirements, might be equally satisfied. Cutting ten minutes off the two-hour outage time for the rural customers would not be noticeable, but ten minutes would be a 50 per cent reduction for the commercial customers. To consider that, from the customers' standpoint, a reduction from two hours to one hour in the first class is of comparable value to a reduction from twenty minutes to ten minutes in the second class may be debatable, but it certainly is nearer the truth than the assumption that the same number of minutes

[*Continued on page 106*]

Capacitors Programmed for Growing Distribution

Decisions based on the costs and gains of alternative methods of increasing the system capacity, improving voltage, enlarging revenue and reducing system losses

V. C. RETTIG,* Electric Distribution Department, Cincinnati Gas & Electric Company

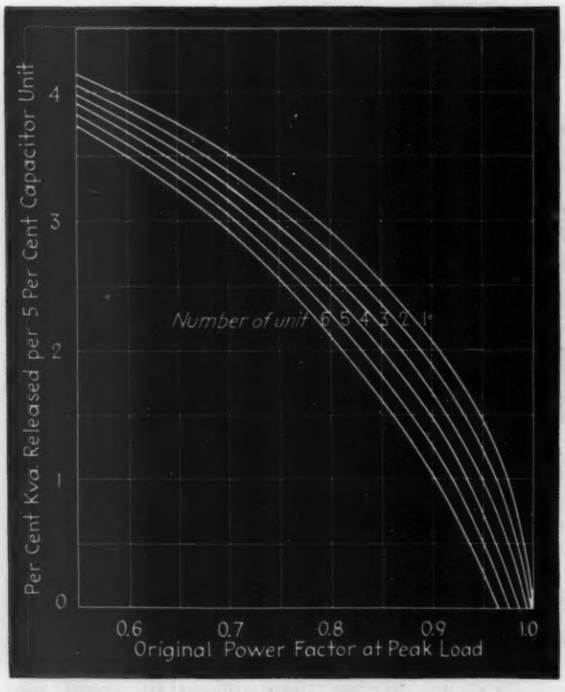
GREATEST VALUE of the capacitor on electric distribution systems is that it increases the capacity of circuits carrying reactive load currents. A complete study of the optimum balance between capacitors and new circuit capacity also involves a study of saving in copper losses, improvement in voltage, which may or may not increase revenue, and a consideration of such factors as new emergency tie capacity that may be provided by a new circuit.

The increase in circuit capacity on any part of a power system resulting from capacitors should not be valued as new capacity unless it will be necessary within a period of several years. There should be some tangible saving or postponement of investment for some definite period of time in any part of the system where increase in capacity is valued as such. Unless this is true, the saving in copper losses and any desirable voltage improvement are the only immediate benefits. When evaluating saving in losses in the parts of the system where the increase in capacity is evaluated, the saving in losses from circuit additions should also be taken into account. When put on the basis of equal increases in kva. or circuit capacity, the increase obtained with a new circuit will save 50 to 60 per cent as much of the losses as that obtained with capacitors. For capacitors connected to a circuit at all times the saving in losses may be readily estimated from a group of curves without knowing the original losses. The only characteristics of the load that need be known is the rkva.-hrs. supplied by a circuit and the approximate distribution of the rkva. load along that circuit. The saving in losses in a feeder main from three equal capacitor units will be within a few per cent of the saving when capacitors of the same total rating are distributed along the feeder main in the same way as the reactive load.

The possible increase in revenue will be small on a well-regulated system. In those extreme cases where the feeder is so long that regulators cannot maintain acceptable voltage at all points the increase in voltage to make it satisfactory will be more important than the increase in revenue. Unless some special provision is made for control a static capacitor has an effect on voltage at any point similar to that of a fixed booster. The fixed boost can usually be obtained with a fixed booster at a much lower cost. Capacitors, however, may be installed in preference to other system additions because they serve several functions, whereas the alternative circuit additions serve only one purpose.

If capacitors are added to the power system as load in certain areas makes an increase of capacity necessary, they provide an effective means of adding capacity in small increments. The installed units will then be paying their way at all times until the optimum economic balance between investment in capacitors and other equipment is reached.

It is proposed here to set up a basis for evaluating capacitors on the distribution system to determine how many can be justified on various parts of the power system and to determine when they should be added. Relationships



PER CENT INCREASE in capacity per capacitor unit—Capacitors added in units equal to 5 per cent of the line or equipment kva. rating. Based on added load of same power factor obtained without overloading

*Excerpts from the E.E.I. paper which was awarded the first of three James H. McGraw prizes for "most meritorious on any engineering or technical subject relating to the electric light and power industry."

have been simplified and curves are included for quickly estimating the increase in carrying capacity of circuits, as well as for estimating losses and the increase in revenue from improved voltage, as capacitors are added in groups or increments. Economic comparisons are made between annual fixed charges on capacitors and annual return for specific cases.

Installation of capacitors on the 4,150-volt feeders only is considered. Capacitors for operation at this voltage can be obtained at a lower cost per kva. than any other. The investment in equipment to serve a given load on the 4,150-volt system is greater than at any other voltage on the system and, therefore, the maximum of benefit can be obtained with capacitors there.

Load Carrying

Since capacitors installed on a 4-kv. feeder will increase the load-carrying capacity of the feeder, the substation bank, transmission lines and other parts of the system, and since the capacity released on each part of the system depends on the power factor of the load there, each part is considered as a separate factor.

The curves in the accompanying illustration show the per cent increase in capacity of a circuit as capacitors are added in successive units or increments equal to 5 per cent of the kva. rating of the circuit. The value of this increased capacity depends on whether or not it will be needed within a period of several years. Capacitors installed on a distribution feeder that is heavily loaded will produce an increase in capacity that will be needed within a year. The same capacitors may also increase the capacity of lightly loaded transmission lines or transformer banks where the capacity will not be needed for a number of years.

Cost of some additions may vary over a wide range, depending on location, length of circuits, and the like, and the variation in the cost of others is comparatively small. Where a 4-kv. feeder can be added without constructing a new substation building or structure the cost of new substation equipment is set at $7 per kva. and of 4-kv. cable and 4-kv. overhead line additions necessary to establish a new feeder at $2 per kva. for each. The cost of new transformer bank capacity on the same basis may be between $4 and $5 per kva.

Copper Losses

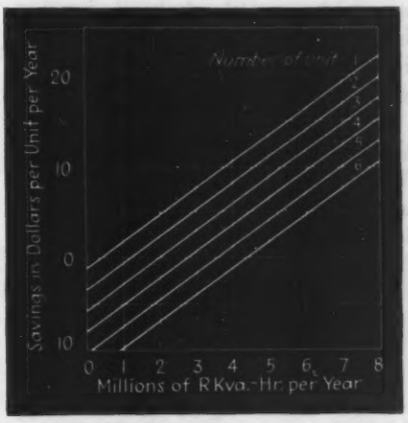
Copper losses on any part of a system vary as the square of the load current, but an analysis of the possible saving in losses shows that the saving bears a linear relationship to the total reactive kva.-hrs. supplied and is independent of the shape of the load curve. The losses in a circuit as well as the possible saving depend to a great extent on how the load is distributed on the circuit. An appendix to the paper gives a detailed derivation of the losses and saving in losses obtained with various arrangements.

The maximum loss obviously occurs when all of the load is carried at the end of the circuit and the maximum saving in loss when all of the capacitors are located at that load. This is true of the large majority of the transmission circuits on a power system. On most of the 4-kv. distribu tion feeders the condition of uniform load distribution along the main part of the feeder is approached. The loss when all of the load is uniformly distributed along all three phases is only one-third as great as when it is all at the end.

The Cincinnati system employs the "phase area" method of voltage regulation for single-phase load; that is, all single-phase load in an area close to the substation is carried on phase one, all in an adjacent area on the feeder on phase two and all at the end of the feeder on phase three. With this system a feeder carrying single-phase loads only, which are uniformly distributed along a feeder, will have a loss in the phase conductors only equal to 4/9 of the loss with all loads balanced at the end. If the loss in a neutral conductor equal to the phase conductor and grounded only at the substation is added the ratio becomes 0.613.

A study of savings in losses deals with the reactive current only, which can be dealt with independently of the power components of current. The saving in losses in kw.-hr. bears a linear relationship to the rkva.-hrs. supplied by a circuit and is a maximum when the rkva.-hrs. taken by the circuit is equal to the leading kva.-hrs. taken by the capacitors connected to the circuit. This is shown in accompanying illustrations for some common lines and transformer banks. Pertinent points to serve as a guide in using these illustrations are as follows:

1. Capacitors installed in three units at the 1/6, 1/2 and 5/6 points on a feeder with uniformly distributed load will give a reduction of losses in the feeder main at least 97 per cent as great as the reduction ob-



SAVING OF COPPER LOSSES in phases per 90-kva., three-phase capacitor unit

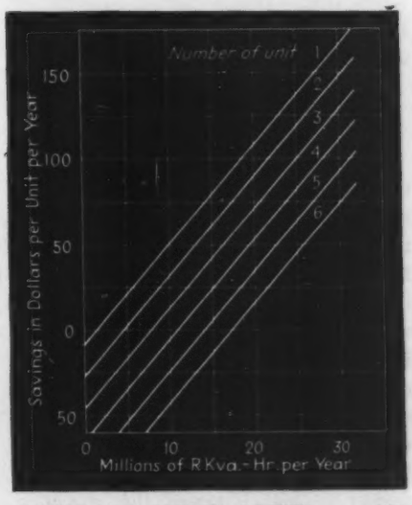
Applicable to—

(a) Per 1,000 ft. of 4-kv. cable of No. 4/0 copper (R=0.56 ohm per phase) with all load at end.

(b) Per 2,000 ft. of 4-kv. feeder of No. 2/0 copper (R=0.168 ohms per phase) with uniformly distributed load.

(c) On 3,000-kva., 4-kv. bank (R=0.56 at 13.2 Rv.)

(d) Per 10,000 ft. of 13.2-kv. line of No. 4/0 copper (R=0.56 per phase at 13.2 kv.) with all load at end.



SAVING OF COPPER LOSSES per 360-kva. three-phase capacitor unit

Applicable to—

(a) Per 10,000 ft. of 13.2-kv. cable of 400,000=circ. mil copper (R=0.28 ohm at 13.2 kv.) with all load at end.

(b) On 6,000-kva., 4-kv. bank (R=0.28 ohms at 13.2 kv.)

(c) Per 10,000 ft. of 33-kv. line of No. 2 copper with all load at end.

tained when the capacitors are installed in very small units in the same way as the individual loads. This indicates that capacitors can best be installed in large units and in most cases one in each phase area.

2. When capacitors are installed in three-phase units on a feeder supplying a given rkva.-hr. load the saving in losses in kw.-hr. is the same for both the rotated feeder and the one laid out with phase areas; that is, it is independent of the balance of load on the phases. This permits the same curves to be used for all feeders.

3. A capacitor unit will produce the maximum reduction in kw.-hr. loss on a feeder when it is installed at a point where the rkva.-hrs. carried by the phase conductors is equal to the leading kva.-hrs. taken by the capacitor unit; that is, when rkva.-hr. equals 8,760 kva. This is independent of load balance.

4. The saving in losses on a feeder main, with all single-phase load uniformly distributed in phase areas, will be 33 to 80 per cent greater when single-phase capacitor units are used than when the units are connected three phase. The difference depends on the resistance of the neutral return.

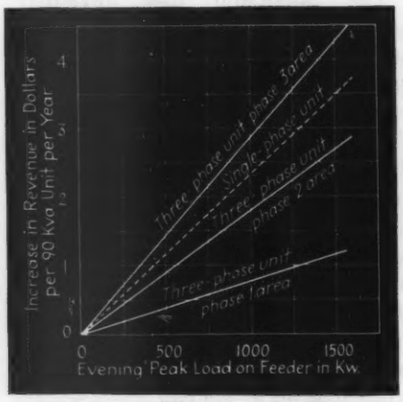
5. For loads between 50 and 100 per cent power factor an increase in kva. of load-carrying capacity obtained by circuit additions will produce a saving in losses of only 50 to 60 per cent of the saving produced when that same increase in kva. of load-carrying capacity is obtained with capacitors.

Increase in Revenue

In the case where all load on a circuit is connected at one point the automatic voltage regulators can be made to maintain the maximum permissible voltage at that load. Fixed capacitors on a feeder with voltage regulators can be made to produce an increase in revenue only when load is distributed along the feeder. The possible revenue increase on a feeder with phase areas is smaller than on a feeder where load is rotated on the three phases, because the distance from the first to the last customer controlled by any one regulator is smaller.

On the Cincinnati system the voltage regulators are set to maintain the maximum desirable voltage at the beginning of each phase area and the voltage drop from the beginning to the end of the phase area is less than 2 per cent on most feeders. With a multi-grounded neutral and load uniformly distributed the voltage drop from the beginning to the center of the phase areas will be 75 per cent of the total. Assuming, then, that the maximum permissible voltage is still maintained by the regulators at the beginning of each phase area, after capacitors are in operation, the reduction of drop to the center of the phase area produced by capacitors cannot be permitted to 75 per cent of the total drop. Within this limit capacitors will increase the revenue.

The average increase in voltage throughout the phase area will be 75 per cent of the maximum increase



INCREASE IN ANNUAL REVENUE per 1,000 ft. of 4,150-volt No. 2/0 feeder

For 90 kva. capacitor units installed at centers of phase areas.

Cost of energy 1.5 cents per kw.-hr.

Based on 1,000 hours use per year of maximum kw. load.

with a capacitor unit at the center of the area. With this as a basis, and assuming the kw.-hr. consumption to increase as the 1.6 power of the voltage, the curves in the accompanying illustration are drawn. It should be noted in connection with these curves that the only very common load on a distribution system for which an increase in voltage will produce an increase in kw.-hr. consumption is lighting load, and that for lighting the consumption increases as the 1.6 power of the voltage. This also applies to less common loads, such as resistance heaters.

An estimate of the load factor of lighting load only on the 4-kv. system showed that it was less than 15 per cent. The curves are calculated on the basis that the kw.-hr. consumption from lighting and similar loads is equal to 1,000 hours use per year of the peak evening kw. load on the feeder and that the revenue increase is at the minimum block rate of 1½ cents per kw.-hr.

Unsatisfactory Voltage

The correction of unsatisfactory voltage conditions will itself sometimes justify the installation of shunt capacitors on a large system, but it is usually only one of the factors contributing to their value. The value and the method of installing capacitors for this purpose depend on: (1) Whether voltage variation from light load to peak load is excessive and requires controlled boost or whether the voltage can be boosted at all times; (2) whether the improvement in voltage is needed with normal system connections or only with emergency connections.

Capacitors installed to operate 24 hours per day produce a fixed boost on a circuit at all times, the maximum boost depending on the reactance from the power source to the capacitor. (3) A similar effect on the voltage at any one point can be obtained with a fixed booster installed in the line or by changing transformer taps. By properly locating fixed boosters or fixed capacitors on a radial feeder equipped with automatic voltage regulators, it is possible to reduce variation in voltage as well as to reduce drop in voltage.

In any case, the fixed booster can usually be considered as an alternative to the fixed capacitor for the correction of voltage with normal circuit operation. The fixed booster will in practically all cases give the required boost in voltage at a much lower cost. However, the capacitor will give a more uniform improvement in voltage along a feeder and the other benefits, combined with its function as a booster, may show that it is to be preferred to the fixed booster.

It occasionally happens that the variation of voltage on a substation bus becomes so great that voltage regulators cannot maintain good voltage at the ends of some of the feeders supplied from that bus, or voltage variation at unregulated customer stations becomes too great. In such cases good economy may be found in the installation of a block of capacitors on a 4-kv. substation bus arranged so that they can be cut in and cut out as load or voltage conditions warrant.

Tracer Impulses Locate Cable Faults

Safe, expeditious method accurately finds all types of faults on 13.2-kv. network feeders without field calculations or disconnecting network transformers

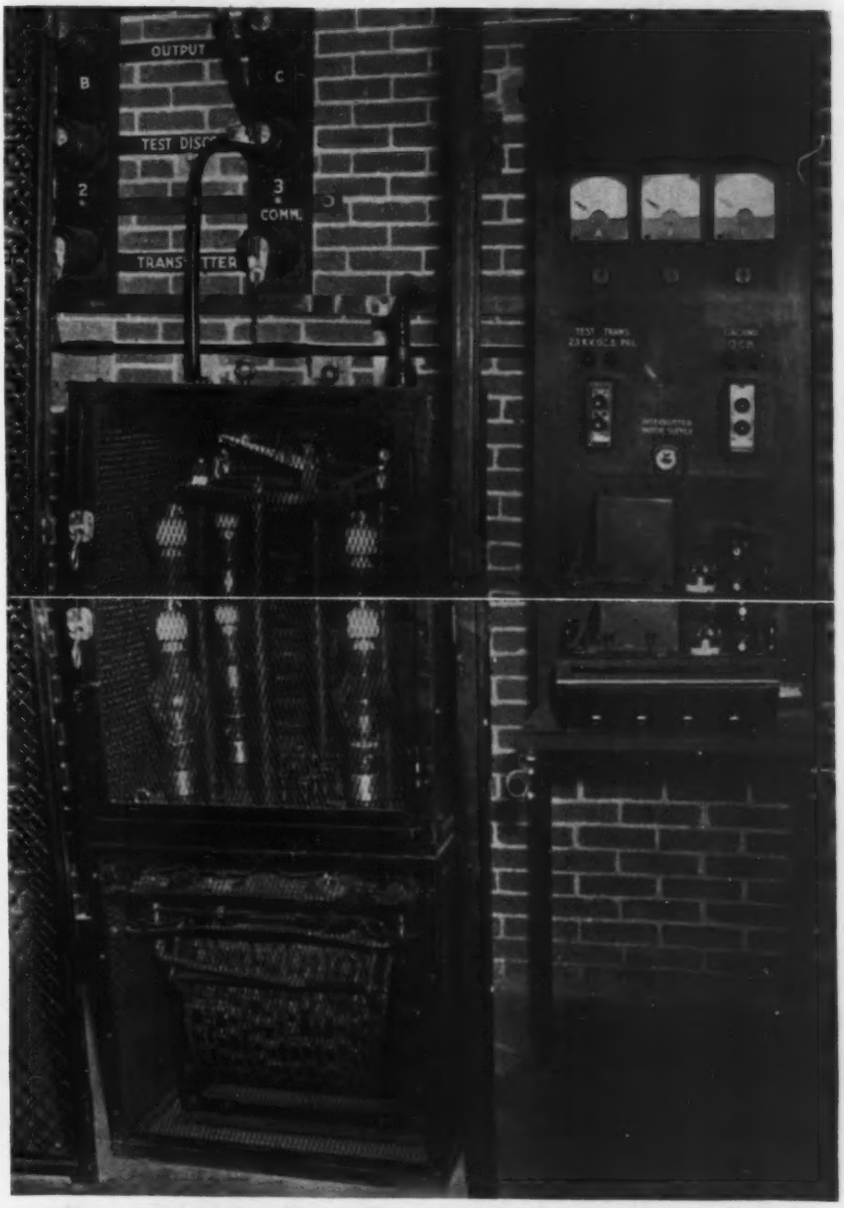
P. L. WEIR,* Potomac Electric Power Company, Washington, D. C.

THOROUGH INVESTIGATION of methods of locating cable faults has led to adoption on the Potomac Electric Power system of the method employing directional impulse tracing currents. Two station equipments are now installed (with a third on order) and faults are being located in about two hours' time (1) because no field calculations are required; (2) because it is not necessary to disconnect the network transformers; (3) because accurate records of conductor lengths are not a requisite to the procedure, and (4) because use of the equipment carries no exposure to high-voltage test circuits. If the resistance of the fault can be reduced, the grounds, shorts, opens or involvement of several conductors are detected with equal facility on multiple-conductor, paper-insulated, non-shielded and shielded lead-covered power feeder cables operated at 6.6 and 13.2 kv.

Prior Practice Inadequate

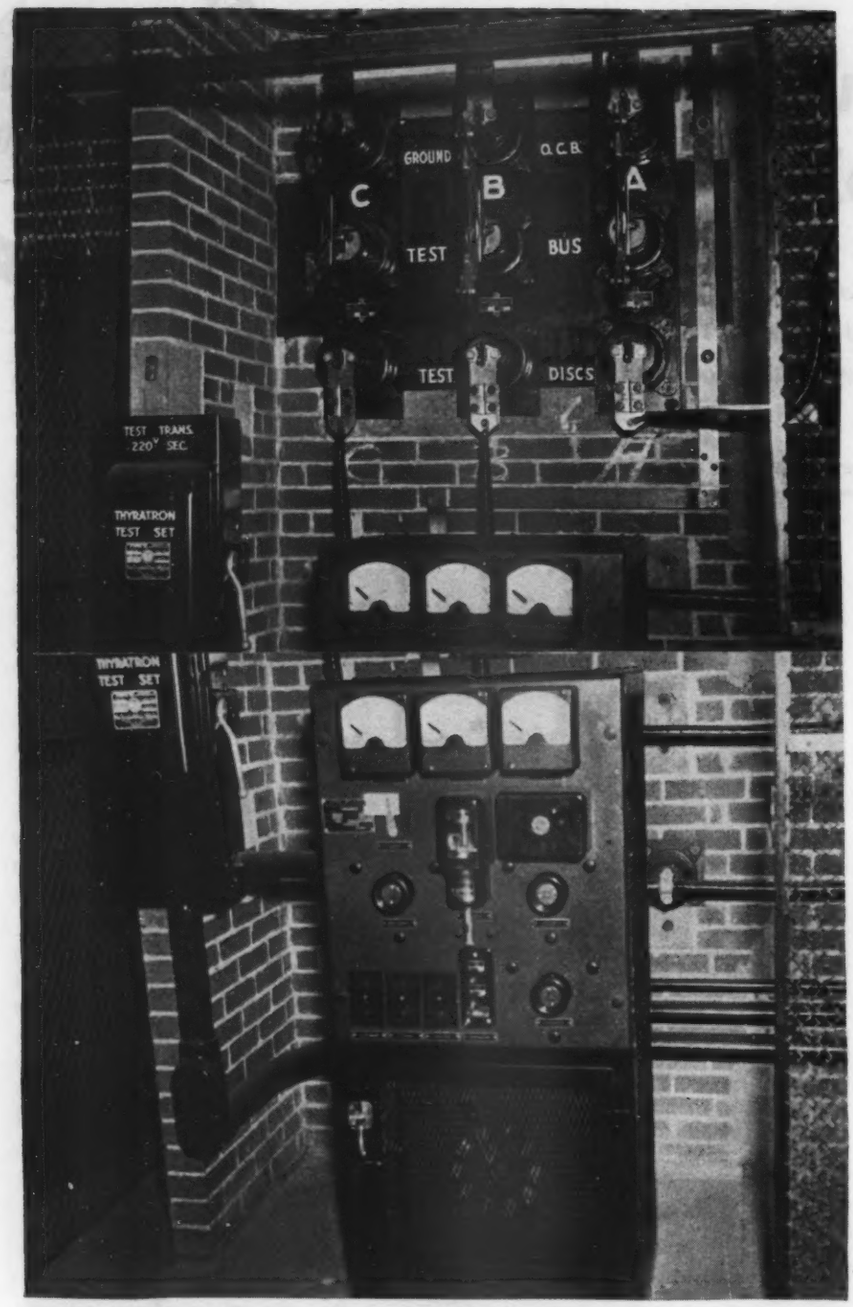
During 1937 it became evident that procedure in locating cable faults by joint reliance on patrolling inspection and the use of a.c. tracing current was inadequate. Inspection was taking from one to 36 hours and required many men from regular production work. Of a total of 25 faults in 1937, the engineers were able to locate three by use of a.c. tracer current, the remainder being located by patrol and inspection, or were reported on by non-employees.

Removing manhole covers during night or rush hours tends to expose



THYRATRON RECTIFIER EQUIPMENTS at Buzzards Point station supply high-voltage d.c. for tracer impulse. Grid control readily interrupts 5-10 amp. d.c. at 10,000 volts. Full-wave rectification from two tubes in bridge arrangement

*Cable engineer.



Supplementary unit comprises current-limiting reactor, motor-driven interrupter, control equipment and control panel

The reactor is designed for 100 per cent voltage drop at full load current in the full winding. It automatically limits the tracing current to full load rating of the transformer, when the resistance of the fault is reduced to zero

company employees and the public to traffic hazards. Faults were difficult to detect in flooded manholes. If well back into the duct, the cable had to be cut, sometimes in four or more locations. Reinforcing made for expense and delay in service restoration. In short, records indicate that location of faults by patrolling was far more reliable than by the a.c. tracer methods then used.

It was frequently difficult to detect abrupt change in signal by ear. The signal often carried beyond the fault. There was difficulty in reducing fault resistance enough to pass detectable fault current even with a 250-kva. transformer. If the voltage was raised high by induction regulator, the high current tripped the breakers; if the fault resistance was reduced the high current did the same; if not, the charging current would do so.

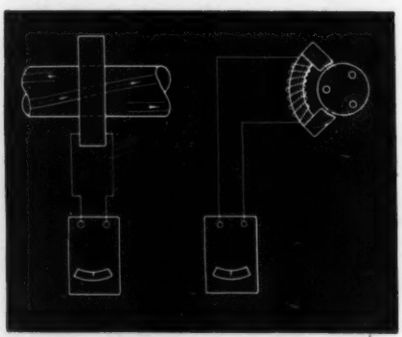
Three Potomac Electric Power Company engineers were much impressed with the success of Consolidated Edison engineers in the use of d.c. tracer impulses, particularly after witnessing the location of a fault on a 13.8-kv. cable. The method used was described in ELECTRICAL WORLD in the December 26, 1935, issue, and this in turn was an improvement on one described by W. R. Bullard in the November 27, 1920, issue.

As a result of this assurance, specifications were given to the General Electric Company for equipment to generate the tracer current. It was placed in service at Buzzards Point generating station in 1938. The necessary portable test equipment was built in company shops from designs furnished by Consolidated Edison engineers.

The station equipment is rated 5/10 amp. at 10,000/5,000 volts based on intermittent operation, with interrupter running on two-second duty cycle. Input at this rating is approximately 250 amp. at 220 volts, 60 cycles, single phase. It consists of a rectifier unit, transformer, current-limiting reactor and control panel. The thyratrons with grid control readily interrupt 5 to 10 amp., d.c., at 10,000 volts, and give full-wave rectification. A motor-driven "interrupter" reverses the grid circuit by means of four single-throw mercury switches mounted on movable supports at such angles that when two switches have their contacts closed the other two are open.

Directional Impulse Tracer

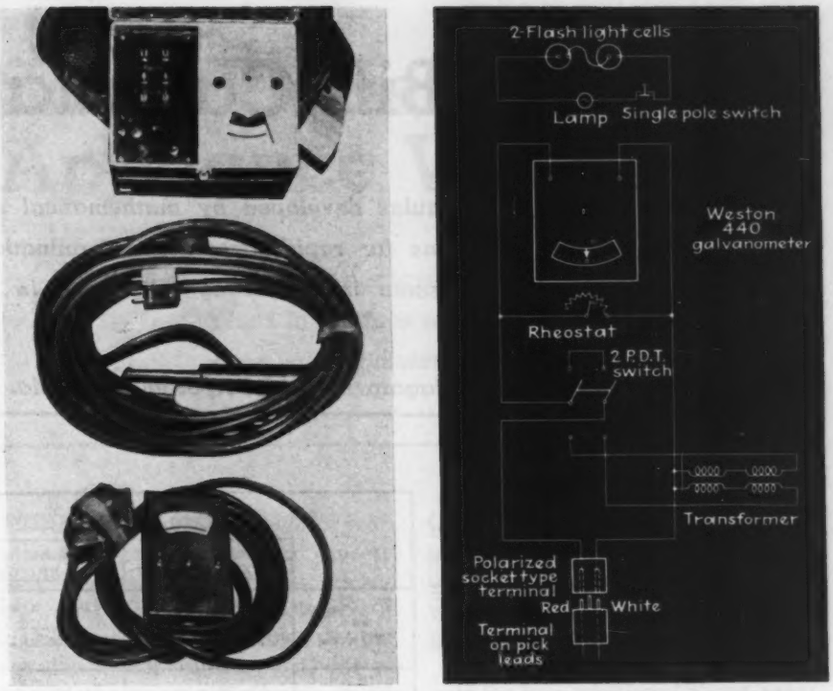
In the circuit of the fault the amount of tracing current flowing in the sheath of the faulted feeder is greater than elsewhere in the sheath. Two different tracing current indicators are generally used, one induced by the impulses in the con-



CABLE FAULT located by galvanometer connected to exploring coil held adjacent to cable

ductors of the faulted feeder and one due to the potential drop of the tracing current flowing in its sheath. A portable, low-resistance, center-reading galvanometer is used to obtain both these indications.

With the tracing current flowing in the faulted feeder and the galvonometer connected to an exploring coil placed adjacent to a faulted feeder in a manhole a sizable deflection indicates (1) that tracing current is flowing in the conductors and (2) that the reading is being taken between the sending end and the fault and at a remote distance from the fault. A deflection of one or two divisions indicates closeness to the fault. No deflection indicates (other than cessation of tracer current) too great a distance beyond the fault.



PORTABLE FIELD EQUIPMENT for fault location

Tracer Reverses at Fault

Whether the fault is inside or beyond the test point is then determined. Two polarized contact points or picks with portable leads are then substituted for the exploring coil and the direction of the deflection is noted. The deflections will reverse when the fault has been passed.

If the length of off-and-on periods of the impulse tracing currents were identical it would not be possible with a damped galvonometer to tell when the current was flowing and when not, consequently a change in polarity could hardly be determined. Therefore, the tracing impulses are transmitted on a two-second cycle; for ¼-cycle (½ second) the current flows, and there is no current for ¾ cycle (1½ seconds) to permit the damped galvonometer to drift toward zero. The fluctuations are significant and certain as to polarity, regardless of stray currents.

In addition to the center-reading, low-resistance galvonometer the portable equipment comprises isolating transformer, variable shunt resistor, flashlight cells, instrument dial-illuminating lamp, single-pole light switch, exploring coil with leads and two pick points with leads.

Most faults have been readily reduced and localized. The record embraces 21 faults on cables having (1) 8 x 8/65-in. paper insulation and belt with 8/64-in. lead, operated at 6.6 kv. nominal; (2) 10 x 5/64-in. paper insulation and belt with 8/64-in. lead, operated at 13.2 kv. nominal; and (3) 13/64-in. paper insulation, shielded with 8/64-in. lead, operated at 13.2 kv. nominal. All faults were traced to the right manhole or conduit section. Some required 10,000 volts, but most were instantly reduced with 5,000 volts sufficient to pass from 1 to 5 amp. tracing current.

Average time required per fault of covering time from applications of tracing current to location of fault has been somewhat less than two hours. Darkness, heavy traffic and rain increase the time required.

A fault was located in 1½ hours on a feeder in a duct 9 ft. from the manhole. The arcing noise of the tracing current was not even heard and it is not surprising that careful inspection failed to locate the fault.

Heat and flame from a 10-amp. tracing current has not, so far as is known, damaged adjacent cable.

Faults under water are reduced and located as readily as those above water.

Topping and Condensing in One Turbine

[*Continued from page 49*]

one boiler unit to supply necessary steam to carry full 30,000 kw. on the turbine under the second condition.

The two boiler units installed have a normal capacity of 215,000 lb. of steam per hour each, with a maximum capacity of 250,000 lb. of steam per hour each, thus providing the 430,000 lb. of steam necessary to enable the turbo-generator to carry 30,000-kw. load with maximum permissible extraction for feedwater heating and for use in the low-pressure turbines, when both boilers are in service. The 250,000-lb. maximum capacity will provide for 30,000 kw. output from the new turbine when extracting steam for its own condensate only.

The boiler unit was furnished by Babcock & Wilcox Company with the exception of the pulverizers, which were furnished by the Raymond Division of the Combustion Engineering Corporation.

In order to make the most desirable layout possible, it was necessary to remove two of the larger 250-lb. boilers, even though they were considerably newer than the smaller ones. However, the location obtained for the new steam generators by removing the two larger boilers was much closer to the only practical location for the new turbine than the space obtained by removing some of the smaller boilers would have been. But the boiler room is worth a story in itself. Further details of it and of other features of the station will be told in a later article in ELECTRICAL WORLD.

Short-Cut Bill Calculation

Formulas developed by mathematical synthesis of rate elements provide means for rapid, accurate determination of billing amounts — Useful to salesmen in estimating bills, also in rate and accounting departments

ROSCOE McMILLAN, Buffalo Niagara Electric Corporation, Buffalo, N. Y.

SOME short-cut methods of calculating electric bills have been in use for many years. They are used for quick computations when talking with consumers or prospective consumers and for checking the accuracy of bills before delivery to consumers.

When an important power rate, for example, is to be revised the management naturally wishes to know the effect on the revenue. This may be estimated with fair accuracy by taking one or two or more typical months and calculating the bills on the proposed rate for a certain percentage of the consumers or for all the consumers and comparing the total with that received under the old rate. There is always the danger that the months or the consumers selected will not be entirely typical of the year's business and the final estimate may be in error by a considerable amount. The use of a formula for calculating the bills in groups or even singly may make it possible to calculate all bills for a year and thus assure an accurate statement of the effect of the new rate on the revenue.

The simplest formula is, of course, that for a block rate such as is commonly used for small retail consumers. Suppose we have such a rate reading as follows:

First 25 kw.-hr. at 7 cents
Next 25 kw.-hr. at 5 cents
Next 50 kw.-hr. at 4 cents
Additional kw.-hr. at 2 cents

If the consumer uses more than 25 and not over 50 kw.-hr. it is plain that he pays at least 5 cents per kw.-hr. for all his use and 2 cents extra on the first 25, or 50 cents additional. The formula for any bill from 25 to 50 kw.-hr. is therefore 5 cents × total kw.-hr. plus 50 cents.

If the consumer uses more than 50 kw.-hr. and not over 100 kw.-hr., then he pays 4 cents for all kilowatt-hours and an additional 1 cent each on the kilowatt-hour billed at 5 cents, and an additional 3 cents each on the first block, making a total of $1. The formula for any bill from 50 to 100 kw.-hr. is therefore 4 cents × total kw.-hr., plus $1. In the same way a formula may be developed for uses greater than 100 kw.-hr., which we find to be 2 cents × total kw.-hr. plus $3.

When we come to rates with a demand charge and an energy charge the formula is developed in the same way, but in two parts, and then the two constant amounts to be added can be taken together and used as one in the final formula. A two-charge rate of this kind might read as follows:

$2 per kw. for the first 10 kw. of demand.
$1.00 per kw. for additional kw. of demand.
3 cents per kw.-hr. for the first 100 kw.-hr.
1 cent per kw.-hr. for additional kw.-hr.

We have four possible conditions:

(1) Demand less than 10 kw. and kw.-hr. less than 100.
(2) Demand less than 10 kw. and kw.-hr. over 100.
(3) Demand over 10 kw. and kw.-hr. less than 100.
(4) Demand over 10 kw. and kw.-hr. over 100.

The formula for the first three conditions should be easily deduced from the foregoing explanations and with the aid of the following study of the fourth condition. We have two parts of the formula to be developed in the same manner as for the block rate above.

A consumer using over 10 kw. of

	Not over 500,000 kw.-hr.		Over 500,000 kw.-hr.	
	Not over 200-hr. use	Over 200-hr. use	Not over 500 M. plus 200-hr. use	Over 500 M. plus 200-hr. use
75 kw. to 200 kw.	$1.50 x kw. plus 0.7¢ x kw.-hr.	$1.70 x kw. plus 0.6¢ x kw.-hr.	x x	x x
200 kw. to 600 kw.	$1.20 x kw. plus 0.7¢ x kw.-hr. plus $60.00	$1.40 x kw. plus 0.6¢ x kw.-hr. plus $60.00	x x	x x
600 kw. to 694 kw.#	$1.10 x kw. plus 0.7¢ x kw.-hr. plus $120.00	$1.30 x kw. plus 0.6¢ x kw.-hr. plus $120.00	x x	x x
694 kw.# to 2,500 kw.	Same as above	Same as above	$1.30 x kw. plus 0.5¢ x kw.-hr. plus $620.00	$1.50 x kw. plus 0.4¢ x kw.-hr. plus $1,120.00
2,500 kw. and over	Same as above	Same as above	$1.10 x kw. plus 0.5¢ x kw.-hr. plus $1,120.00	$1.30 x kw. plus 0.4¢ x kw.-hr. plus $1,620.00

#This is the demand whose continuous use every hour of a 30-day month will result in an energy consumption of 500,000 kw.-hr. For a 31-day month and for February the figure will be different.

FORMULAS for a complicated rate

demand pays at least $1 per kw. on all and an additional $1 per kw. on the first 10 kw. The demand charge can therefore be calculated quickly by taking $1 per kw. and adding $10. In the same way the energy charge can be determined by taking 1 cent per kw.-hr. and adding $2 (2 cents additional on 100 kw.-hr.). The entire formula can then be stated:

$1 per kw. of demand.
1 cent per kw.-hr. used.
Plus $12 ($10 plus $2).

The ordinary method of calculating this bill would require two subtractions, four multiplications and one addition. By use of the formula this is reduced to two multiplications and one addition.

The formula can also be used for the total of a number of bills if we remember that the $12 charge is for each bill. For example, suppose we find that John Smith's record for a twelve-month period shows that his demands totaled to 226 kw. and his energy use was 25,000 kw.-hr. The calculation of the total bill for the year can be made as follows:

226 kw. at $1	$226.00
25,000 kw.-hr. at 1 cent	250.00
12 bills at $12	144.00
Bill for the year	$620.00

The above calculations are quite elementary, of course, and simply indicate the general method of developing the formulas. The chief purpose here is to call attention to the value of the method and to show that formulas can be developed for almost any of the more complicated rate structures.

Therefore, without taking more time or space to develop formulas, let us close with an example of a rate that requires several of them to cover the various conditions.

The rate as stated:

Service available for demands of 75 kw. or more.

Demand Charge:
$2.00 per kw.—first 200 kw.
1.20 per kw.—next 400 kw.
1.10 per kw.—additional kw.

Energy Charge:
0.7 cent per kw.-hr.—first 200 hours use of demand, but not over 500,000 kw.-hr.
0.6 cent per kw.-hr.—remainder of 500,000 kw.-hr.—if any.
0.5 cent per kw.-hr.—next 200 hours use of demand.
0.4 cent per kw.-hr.—additional use.

We find that ten different formulas are required to cover all the conditions. A handy arrangement of these for daily use appears in the accompanying illustration.

Sales Plans Seek Appliance Volume

Test survey shows utilities design compensation plans to produce appliance volume — Major appliance sales stimulated by commissions and bonuses

DURING the past eight years utility companies have found it necessary to go out into the highways and by-ways to induce their customers to purchase more and more electric service due to the utilities' need for an accelerated growth in receipts. In the past year or two claims have been made that such selling efforts on the part of utilities should be conducted without regard for the practical considerations which other sales efforts must respect. Specifically they refer to paying salesmen on sales volume of kilowatt-hours or appliance volume. Almost simultaneously certain other observers of the utility industry companies complain that its selling effort is lackadaisical and therefore of little value.

To present some of the facts of the moment with respect to utility selling policy in the residential field the results of a recent survey are presented in following data. Outstanding fact is that utilities represented by this cross-section embracing large and small companies in many sections of the country are engaged in straight selling operations and are doing so by compensation plans which put a premium on volume sales of appliances.

Appliance Volume

In this important sphere of operations utilities, dealers and manufacturers see eye to eye therefore on the need for consistent sales of appliance volume. Load building dictates direction of sales, but volume is the equally desirable goal, according to these reports from utilities.

In support of this point, it will be noted that only two reporting companies pay salesmen on a strict salary basis. Two more companies (one in Oregon and one in Mississippi) report salary payments exclusively, but these are based upon E.A.R. quotas, which in turn reflect volume sales of major appliances.

All of the companies, excepting only the four mentioned above, report sales compensations with a volume component, such as commissions and bonuses which are related directly to appliance sales volume or are related to it indirectly by payments based upon kilowatt-hour usage, connected kilowatts or E.A.R.

Average Income

Turning to average income received by utility salesmen, it will be seen that payments range from $1,325 ($890 for junior salesmen) to $3,600 per year. The average sales income is $2,128, compared, by way of example, to the average income of less than $1,400 for all utility employees in 1938.

The salesman worked for his above-average pay for, as previously stated, most of the salesmen are paid on schedules which by commissions and bonuses put a premium on appliance sales volume. Two companies in Pennsylvania, one in Missouri and one in Alabama report that their salesmen are paid exclusively on a commission basis. A fifth company, located in Iowa, reports payments on a commission basis but with a guaranteed salary, so that in reality the plan probably operates almost as a salary and commission arrangement.

More than one-half of these companies report that 50 per cent or more of the salesmen's compensation is derived from commissions: three-quarters of the companies report that

[*Continued on page 104*]

Technological Security Stressed at A.I.E.E. Forum

Advances in technique and equipment, coupled with basic approaches to transportation adequacy and to statistical standardization of production control, mark engineering meetings held at Swampscott

PREPAREDNESS of the nation received attention directly and indirectly in the deliberations of the American Institute of Electrical Engineers in convention at Swampscott, Mass., June 24 to 28, 1940. Adequacy of transportation was a major topic and it was rued that economic factors had deterred the electrification of our railroads; the Diesel-electric locomotive was featured as a positive contribution in the absence of support for extensive traction electrification. One of the informal conference sessions launched the first steps toward possible sponsorship of an industry standardization of terminology, technique and practices in the field of statistical formulation of the urgently needed specifications and quality control in production, along with the research and engineering approaches to facilitated product development, output and purchasing.

Load swings, governing, stability, test codes and field dielectric measurements were topics of other informal conference sessions. The following are condensed discussions of the formal papers presented in the sessions of greatest interest in the power field.

Power Transmission

Shielding of Transmission Lines. By **C. F. Wagner, G. D. McCann** and **G. L. MacLane, Jr.** (all Westinghouse).

Lightning model tests correlated with field reports of lines indicate that to limit strokes to 1 per cent of the strokes to the line for a cloud height of ten times the ground wire height a protective angle of 50 deg. is necessary for y/h equal to 0.2. High soil resistivities (also canyons and valleys) lower effective ground plane and increase outages. Recommended protective angle to allow for this, for slope, wind, etc. is 30 deg. In view of such data as the authors have been able to obtain it is believed that an altitude of 1,000 ft. for the origin of the stroke is sufficiently representative and pessimistic for use in this paper.

Abnormal Voltage Conditions in Three-Phase Systems Produced by Single-Phase Switching. By **Edith Clarke, H. A. Peterson, P. H. Light** (All General Electric).

Gives results of investigation to determine conditions under which high voltages may occur with one and two conductors open, with and without faults. Suggests rules for application of fuses and single-pole switches. Formulas given for boundary application of single-pole switches or fuses in terms of line length and capacitance.

Arcing Faults in Power Systems. By **C. Concordia** and **H. A. Peterson** (both General Electric).

In general, resistance grounding results in lower switching surge voltages than reactance grounding except at and in the region below the ground fault neutralizer impedance. Arc restriking may cause abnormally high surges on isolated neutral systems. For interruption of open lines circuit breakers with minimum tendency to restrike should be used.

W. B. Morton, Philadelphia Electric; R. W. Wilbraham, United Engineers & Constructors, Philadelphia; A. B. Craig, Boston Edison

E. J. Allen (General Electric) said several complete installations of protector tubes have been made on lines already equipped with overhead ground wires where the shielding angle was from 37 to 55 deg. in excess of the 30 deg. of the paper. They were primarily installed because high tower footing resistance had prevented full benefit of the ground wires.

Taking cloud height at 1,000 ft. for model studies was not supported by aeronautical meteorological observa-

tions, said E. E. George (Ebasco Services), but that, with cloud height entering the formulation of protective angle it should embrace the range of mid-cloud values corresponding to a possible maximum of 20,000 ft. for cloud tops. I. W. Gross (American Gas & Electric Service) is adhering to a one-over-two ratio of rod height to horizontal protection. It is difficult at times to get even a 25-f. column extension without exceeding structural strength limitations. To adhere to 30 deg. shielding would often call for 40 ft.

The great majority of the hundreds of thousands of line fuses close to terminals of high-voltage transformers are not subjected to the overvoltages discussed in the paper read by Miss Clarke and thus they give better performance than might be inferred from it, was the opinion of E. J. Allen (General Electric). His conclusion was that single-pole fusing may safely be used for single-phase branch lines and sectionalization except on isolated-neutral lines of higher than 2.3 or possibly 6.9 kv.

H. W. Martin (Allis-Chalmers) emphasized the importance of circuit breakers with (1) low arc extinction voltage, (2) a rate of dielectric recovery always in excess of the rise of recovery voltage and (3) a means of damping high-frequency transients. He felt that the axial-blast breaker offered these desirable characteristics. A. C. Monteith (Westinghouse) preferred to analyze the arcing-ground and switching-surge characteristics of each particular system rather than rely on generalized mathematics because of the many complexities involved. He said we are steadily getting nearer the elimination of arcing grounds and switching transients.

Protective Devices

A High-speed Differential Relay for Generator Protection. By W. K. Sonnemann (Westinghouse).

Relay discriminates between true differential current of tripping magnitude and false value traceable to dissimilar performance of current transformers under d.c. transient conditions. Variable-ratio characteristics employed. Relay less sensitive at higher restraint values when differential current is out of phase with restraining current.

Harmonic-Current-Restrained Relays for Transformer Differential Protection. By C. D. Hayward (General Electric).

Distinguishes between differential current due to an internal fault and that due to magnetizing inrush on basis of difference in waveform. It operates with high speed on fault; restrained from operating on magnetizing inrush. Current operated and requires no potential transformers.

On the Sonneman paper L. F. Kennedy (General Electric) stated that the effort should go on to obtain current transformers of good characteristics for relaying despite the development of this variable-ratio relay to compensate for current transformer shortcomings. He deplored somewhat the introduction of a device sufficiently unstable to require complicated restraints against unwanted vibration operation which in effect make the device a low set instantaneous overcurrent relay. P. O. Langguth wrote in that existing designs of bushing transformers (often housed within circuit breakers) were occasionally unsuitable for differential protection and the variable-ratio relay was intended to render them retainable.

J. R. North (Commonwealth & Southern) could not agree with the statement that it is difficult to relay large power transformers differentially. The most difficult condition is an internal fault remote from the transformer terminals involving an uncertain range of reactance values. He suggested that numerous short-circuit tests should be made to confirm the Hayward claims.

A High-power Oil-less Circuit Interrupter Using Water. By W. M. Leeds (Westinghouse).

Indications are that 60,000 amp. or more at 13,200 volts can be interrupted using either air or water. Voltage removed from interrupting chamber after opening, circuit reclosed in air with water contacts already closed.

Medium-capacity Air-blast Circuit Breakers for Metal-clad Switchgear. By R. M. Bennett and B. W. Wyman (General Electric).

Maximum air economy with cross-blast interruption. Resistance used to provide further air economy in new design based on co-ordination of operating mechanism, air supply, interrupting chamber and resistor.

Dielectric Strength of Water in Relation to Use in Circuit Interrupters. By J. Slepian, C. L. Denault and A. P. Strom (all Westinghouse).

Breakdown between immersed electrodes is, in general, determined by temperature rise produced in the leakage current in the water. Breakdown appears to occur when steam forms. For surge voltages of short duration, the dielectric strength of water is of the same order as insulating oils.

H. A. P. Langstaff (West Penn) felt considerable work was still necessary to make water breakers suitable for American requirements. He asked how quickly could reclosure be effected and what are the relative speeds of reclosing of main contacts and the supplementary air-break? R. A. Hentz (Phila. Electric) also sent in word that two years experience with fifteen G.E. water breakers showed no insuperable difficulties with water and that his company has ordered nineteen more with ratings up to 3,000 amp. and from 500,000 to 1,500,000 kva.

D. C. Prince (General Electric)

M. M. Cory, Michigan State College; C. A. Corney, Boston Edison; W. G. Knickerbocker, Detroit Edison

W. B. Kouwenhoven, Johns Hopkins University, Baltimore; G. V. Smith, Ohio Brass; L. H. Hill, Allis-Chalmers, Milwaukee

said that in the G.E. hydroblast breaker much effort is placed on controlling the amount of steam generated, whereas in the Leeds paper the emphasis is on control of the pressure. He urged tolerance with regard to theories of breaker action because of the economic limitations to breaker testing after J. Slepian (Westinghouse) had questioned the theory advanced for functioning of the G.E. airblast breaker, particularly the hypothesis that all the action is attributable to the main airblast and not partially, at least, to the effect of gas generated at the insulating barriers. J. B. MacNeill said Westinghouse had not expected to use compressed air for much less than 500,000 kva. He did not see the necessity for vertical lift for a non-liquid breaker and preferred horizontal drawout. The Westinghouse breaker has straight vertical air-flow from tank to vent, with horizontal plate segregating the mechanical system from the energized parts.

Testing of Insulation and Cables

Low-voltage D.C. Measurements on Electrical Insulating Oils. By J. L. Oncley and W. C. Hollibaugh (Mass. Inst. of Tech.).

Reports that change of d.c. conductance with time substantiates the theory that low-voltage methods do measure the true d.c. conductance of highly refined electrical insulating oils. The d.c. test accounts for all the loss found by a.c. test.

Rapid-Recording A.C. Bridge. By W. Mikelson and H. W. Bousman (General Electric).

Describes a power factor and capacitance bridge capable of unattended recording of fluctuating or drifting values during life tests, production processes, etc. Automatic balancing broadly applicable.

A Method for Detecting the Ionization Point of Electrical Apparatus. By G. E. Quinn (Consolidated Edison).

A cathode-ray oscilloscope in conjunction with an appropriate air-core reactor will detect high-frequency discharges at or below the minimum voltage at which interference may be noted by a "radio noise influence voltage" method.

The Type CB Impregnated-Paper Cable. By S. J. Rosch (Anaconda Wire & Cable Co.)

Presents progress report on a new method of attacking insulation instability by use of carbon-black (CB) paper to purify the oil and retard formation of deteriorating bodies. Longest voltage life results from having carbon-black paper adjacent to conductors of single-conductor cables.

The Dielectric Strength and Life of Impregnated Paper Insulation. II—The Influence of the Thickness of the Paper. By J. B. Whitehead (Johns Hopkins University).

Decrease in breakdown voltage with increase in thickness was about 28 per cent, with decrease in life of approximately 45 per cent. Failures start in oil channels between convolutions.

There was spirited discussion of the first three papers, with general acknowledgment that they constituted additional tools to use in controlling oil and cable performance, but the focal point in the session discussions was the Rosch paper on carbon-black impregnated paper cable.

H. H. Race (General Electric) wanted to be reassured about the permanence of functioning of the activated carbon throughout the life of the cable. W. A. DelMar (Habirshaw) cited a 1929 British patent featuring paper bearing "soot"; an aluminum-coated paper of 1914 gave better p.f. stability, but at the expense of gassing. He prefers to attain the stability by reliance on paper elasticity and general control of the quality and properties of the dielectric materials. E. R. Thomas (Consolidated Edison) called the cable a direct step toward a desired cable that can be run warmer; his company is installing some of it for performance observation and he does not at this stage exclude the possibility of carbon migration and joint difficulties. Herman Halperin (Commonwealth Edison) hoped, as always, that total insulation thickness can be reduced. Orders have been placed by his company for three-conductor 12-kv. shielded cable with 18 per cent less total thickness than the customary value.

Shielding Effect

R. W. Atkinson (General Cable) said the shielding effect was entitled to more credit than accorded in the Rosch paper. Philip Sporn (American Gas & Electric Service) sent in the remark that the carbon-black development is logical and in the direction of a better and less expensive cable. G. B. Shanklin (General Electric) felt that the carbon black did not prevent oxidation products, but merely delayed their formation; ionization still remains the major problem in his estimation, and thus shielding is the logical corrective toward controlled performance.

J. W. Snyder (Binney & Smith) presented interesting data about carbon black. Particles of less than 30 millimicrons in diameter present in the aggregate an enormous surface for adsorption. E. W. Greenfield (Anaconda) held up a 6 x ¾-in. strip 5 mils thick which he said had 20,000 sq.in. of carbon surface on carbon particles constituting 5 per cent of the total weight of the carbon black tape.

Instruments and Measurements

An Improved Type of D.C. Wattmeter of the Shunted Type. By **Paul MacGahan** (Westinghouse).

Founded on use of low-coercive-force Hipernik for the voltage-coil core (see ELECTRICAL WORLD, June 29, 1940, page 64).

Computation of Accuracy of Current Transformers. By **A. T. Sinks** (General Electric).

Establishes mathematical basis for computing ratio correction factors and phase angles of current transformers by extension of formulas for power transformers. Information for designer and applier. Indicates suitability of available designs for particular applications without need for overcurrent ratio and phase angle tests.

New Instruments for Recording Lightning Currents. By **C. F. Wagner** and **G. D. McCann** (Westinghouse).

Cites fulchronograph, automatic cathode-ray oscillograph, magnetic surge front recorder, magnetic surge integrator and their respective capabilities.

The Output and Optimum Design of Permanent Magnets Subjected to Demagnetizing Forces. By **A. J. Hornfeck** (Bailey Meter) and **R. F. Edgar** (General Electric).

Outlines graphical and mathematical methods of aid to designer in applying permanent magnets to new uses; founded on major and minor hysteresis loops. Emphasis on Alnico and available energy utilization.

A New High-Speed Thermal Wattmeter. By **John H. Miller** (Weston).

Millivolts produced by thermal converter proportioned to polyphase power. Thermocouples function also as heaters to accelerate response without impairing overload capacity. Projected for totalizing and switchboard service.

G. E. Lunge (General Electric) said that the new Weston thermal wattmeter is valuable in the field of carrier telemetering. Economical totalization of readings at the transmitting end of the channel is now to be had without appreciably impairing the over-all speed of impulse telemeter response. Reduced damping at lower voltages is not serious at that end of the scale.

On the third paper W. A. McMorris (General Electric) referred to the point that if the slope of the wave tail exceeds 20 per cent of the front wave slope equipment accuracy may be impaired. This can be met by using two or more magnetic links per coil. The effect of current reversals on the magnetic links, as well as of mechanical vibration, deserves consideration. E. S. Lee (General Electric) pointed out the value of an oscillographic record made twelve years ago. Efforts are being made to cut the cost of the cathode-ray oscillograph, still of major importance in lightning studies. Closing, Mr. McCann said that 35 sets are now in use and that four new field records of direct strokes have been received.

Dielectric Measurements

Insulation testing was the theme of a conference session presided over by G. M. L. Sommerman (American Steel & Wire), field methods being discussed by numerous speakers. A. L. Brownlee (Commonwealth Edison) uses a transformer bridge for power-factor tests, having one outfit on order for 100-kv. service and one in use at 50 kv. The effect of drying bushing barriers has been well demonstrated. A vibration microphone is useful in studying radio interference from potheads. Much remains to be done in power-factor testing of generators.

G. E. Quinn (Consolidated Edison) and H. R. Selfridge (New England Power) recounted successful experience in testing transformers, insulators and bushings by the power-factor method, as a preventive of operating failures. F. C. Doble (Doble Engineering) summarized the experience of his organization in connection with more than 1,000,000 field tests recorded on 70,000 data sheets, covering more than 50 operating systems and establishing standards of insulation quality in apparatus from generator to customer's meter. Service removal on power-factor indications is increasingly under control, and new apparatus for oil, cable and other testing is rapidly coming forward.

Transportation

Modern Rail Transport. By **A. M. Wright** (Central R. R. of N. J.).

Discusses national economics of rail transport, with focus on electrification as a contributor to solution for expanding and recovered traffic. Locomotives of 6,000 hp. and more must be solved by other means than increasing the size of conventional steam locomotive; electric most promising. ". . . a 270-ton electric locomotive being able to do the same work as a 620-ton steam locomotive . . ." "It is at least possible that even a contact line potential of 50,000 volts would be considered." "Availability . . . of . . . electric locomotives usually exceeds 90 per cent, . . . about 50 per cent for steam." "A given tonnage can be moved over the rails at much better scheduled speed." "Maintenance of overhead . . . lines and substations . . . usually . . . same order of magnitude as that of maintaining fuel and water stations for steam traction."

Investigation of Starting Requirements of a 660-Hp. Locomotive Diesel Engine. By **J. C. Davidson** (Amer. Locomotive Co.) and **R. Lamborn** (General Electric).

Tests indicate that torque (supplied from starter and battery) required to turn a hot diesel through its first full compression stroke may exceed that for all other operating requirements. About 7,000 lb.-ft. required at standstill and at least 2,000 at 80 r.p.m. firing speed.

The Application of Electricity for the Auxiliaries of Railroad Trains. By **J. W. Gardner** (Chicago, Burlington & Quincy R. R.).

Possible total load per car set at 30 kw., divided as follows: Lighting, etc., 5 kw.; air conditioning, 10 kw.; water heating, 10 kw.; battery charging, 5 kw. Overhead electric heat (in lieu of steam), 15 kw.

Comment was made on the expanding outlook for fluorescent lighting in passenger cars, with its equivalent saving in train power and adaptability to low ceilings and modern architectural treatment. A fluorescent unit

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Mark Eldredge, formerly Memphis Power & Light; R. W. McEver, and B. H. McColn, Knoxville (Tenn.) Electric Power and Water Boards

Editorials

S. B. WILLIAMS, *Editor*

Normal Business Must Be Served

SINCE THE MIDDLE of April general business has increased steadily until it now is at a high level. The electrical industry has participated in this upturn. This increase in business has not come about by reason of orders for war equipment, although anticipation of greatly improved industrial volume as the result of national defense orders has undoubtedly stimulated the present upturn. This, coupled with a fear of rising prices, has caused not a little long time utility equipment buying.

While some orders for electrical equipment for national defense, especially for the Navy, have been placed, it will be September before the large procurement orders are signed and another four to six months after that before volume production begins to roll. In the meantime, electrical manufacturers can expect to be busy equipping industry for munitions production as well as serving utilities that are strengthening distribution in anticipation of heavy industrial demand.

The problem that is facing individual manufacturers today is the extent to which munitions orders will disrupt normal business. American manufacturing has the capacity to absorb without too much difficulty a large national defense equipment demand provided orders are intelligently placed. Just as it is patriotic for manufacturers to cooperate with government to the utmost so is it patriotic for government to cooperate with business to the end that normal business be unimpeded.

There is a time coming when the preparedness program will be about completed. It would be a calamity if at that time numbers of manufacturers found themselves, as they did in 1919, without orders and their normal trade gone elsewhere.

Some new productive facilities will be required, especially for processes that have no peace time market. There is no reason for factory expansion to produce most of the requirements. Extra shifts can supply the extra demand.

If a program of taking care of the regular trade as well as national defense can be carried out without a large increase in productive space it will be possible to carry on afterwards without another major depression. When business slackens for any reason the thing that makes trouble is the fixed investment cost. Judicious planning in procurement will minimize this difficulty when we shall have completed our preparation for national defense.

Fluorescent Power Factor Clauses

THE PET PEEVE of utilities against fluorescent lighting from the very beginning has been the poor power factor of uncorrected units. Several state utility commissions have handed down regulations covering the installation of discharge tubes. Rate schedules in some instances have recognized the situation.

Undoubtedly this campaign against low power factor has borne fruit for uncorrected installations are now in the minority where once they were the big majority. Likewise it is probably true that the battle against uncorrected installations must continue until high power factor units become the regularly accepted practice.

However, cannot the battle be waged from here on by force of education without the threat of punishment? Power factor clauses for fluorescent lighting either mean something or they don't. If the latter, what good are they? If the former, how are they to be enforced? And that brings up another point—discrimination. If poor power factor is the thing to be routed out, why not go after it wherever it occurs?

Well, of course the answer is obvious. If all installations with poor power factor were to be penalized there would be a great many devices that would be on the black list.

Public relations are not improved through penalty clauses. Education will produce the same result with a much better customer and trade understanding.

Moreover, it's seldom good policy to make a rule that cannot be enforced impartially.

A Danger Meter for Street Lighting

A NEW INTEREST is being aroused in better highway illumination through the use of the street-lighting evaluator. With it the people who are going to determine how much money will be spent locally on street lighting can turn knobs and punch cards and see for themselves what they need.

Strangely enough, it wasn't until we had a simple instrument for measuring light which the public could use that we began to make rapid headway in better lighting. It took the light meter to make the better vision story stick.

It would appear that we are going to need the evaluator to make the night safety story stick. At present, however, the evaluator lacks the one essential of the light

meter—a dial calibration in terms that the public can understand. If, for instance, the evaluator could have a dial which would tell the customer that the light was insufficient for driving up to 25 miles per hour, 35 miles per hour, or any other speed, it would help fix an idea that would go a long way toward making the sale.

It is possible that certain modifiers might have to be used for certain kinds of road or localities, but when these can be worked out and a dial properly calibrated it will be found that this already very useful instrument will do a job for street lighting that nothing else can touch.

Some Utility Buying Practices

SOME PRACTICES have of late crept into utility buying habits here and there which are not improving those companies' relations with suppliers. Nor are these practices looked upon altogether with favor by the men who will have to be responsible for the operations of the lines or stations in which the equipment is placed.

Certain standards of performance based on standards of dimensions, weight and material have been accepted by the industry after long joint deliberation by utilities and suppliers. The suppliers by factory arrangement, tools and method have brought the price down as low as they can. To change to a different design, even with less material cost, would in many cases involve a higher overall cost because some of the benefits of production economy would be lost.

As a rule there is little to choose in price or product among the long established manufacturers. The differences that do exist are of a less tangible but no less real nature, such as coordination with other equipment, parts supply, delivery, service, engineering and the like.

Some utilities, however, are not content with such a situation. They may issue their own specifications cutting down on life values, or factor of safety and expecting to secure lower prices. They get lower prices but more frequently than not from a supplier with less experience.

One organization, we are told, allows not one cent for the intangibles over price and minimum quality. Yet this same utility is daily selling its customers and prospects on the intangible values in utility service. A continuation of sharp buying might cut down the quality of this intangible part of utility service.

Planned Distribution

IN EVERY DECADE we find the attention of the utility industry focused on certain phases of its operation. There was the period of intense activity in connecting up new customers, of decreasing fuel consumption, of transmission line construction, of stock sales to customers, of load building. Now we are looking forward to a period of distribution rebuilding.

In the first place, distribution is the part of the system that has the largest investment and the greatest range of cost flexibility. Some economies will come from generation but so much has already been accomplished that until some new method of taking energy out of fuel becomes practical in large sizes only fractional gains can come from that direction. With taxes, labor and raw materials trending higher there is the necessity of finding offsetting economies in distribution.

The problem facing the utilities is, with the exception of regulated return, the same as that facing all industry. Production costs generally have been reduced to the point where economies are fractional. Lower cost to the consumer must come from savings in distribution.

In the second place, distribution needs rebuilding because of expanding load imposed upon systems already up to capacity. For some time low cost capacity increments have been secured through the use of capacitors and regulators. These did cut down waste and thus enable companies through reclaimed capacity to get the most out of the system.

There comes a time, however, when there is nothing left to do except strengthen the system. That is the job ahead of the utilities in the next decade.

Some companies have prepared themselves for this by planning a distribution system that could handle expanding load at the minimum of expense and disturbance to the rest of the system. In many instances, however, distribution has just grown like Topsy. Those systems need rebuilding according to a planned program.

To help distribution engineers and managements who are now or will be wrestling with this matter of rebuilding, ELECTRICAL WORLD, starting with this issue, is expanding its treatment of distribution to include a series of articles on Programmed Distribution. This series covering economics, analysis, planning, design, construction and operation will be in addition to the comprehensive treatment we have been giving to distribution practice. The articles will be written by well known authors out of their own experience and studies.

Comments of readers either upon the general theme or upon some specific article, as well as suggestions, will be welcomed.

Tennessee Taxpayers May Like Willkie Better

By CARTER FIELD

This noted journalist gives his personal comments and interpretations on current happenings affecting the electrical industry. His background and his location at Washington make his thoughts informative and interesting even though all may not agree with him

"IF PRESIDENT ROOSEVELT is renominated, I will bet that Wendell Willkie carries Tennessee."

The speaker was a very shrewd observer who lives down in the shadow of the Smokies. He knows the folks in the Tennessee Valley. He has been all over the state, talking to gas station attendants, hot dog and soft drink venders, storekeepers and even bankers—he is not very proud.

"It's a funny situation," he explained, "but the folks in Tennessee are awful mad with our President. It's all over taxation. You know it was Willkie's company, the Commonwealth and Southern, which sold out its Tennessee properties to TVA and local public ownership groups. You may not have paid much attention to what has been happening since, but I have, and believe me the folks down in Tennessee have, too.

"The point is that local taxes have been boosted all over the state. I know one little county where the local rate, on farms and town property, has been boosted from $1.13 to $1.53. If you think those folks are not boiling mad you are crazy. You see nobody tries to fool them about the reason. It's simply that the properties once owned by the Tennessee Electric and other subsidiaries of Commonwealth and Southern, not to mention some Electric Bond and Share subsidiaries out around Memphis, are now on the free list at the tax assessor's office. So the rate on everything else has to be put up in order to get the revenue to run the local governments."

Boon Is Unappreciated

"But don't they save more money by the reduction in electric rates?" I asked. "Isn't there a net advantage to them with all this federal subsidy. I've been hearing the taxpayers in Ohio and New York are sore about paying for Tennessee's cheap electricity."

"Maybe so," replied my Smoky Mountain friend, "but they don't seem to realize it. They are mad about their tax bills, with the higher rates. Some counties have already fixed their rates. That is where the irritation is strongest. Some are going to fix the new rates about September 15. That looks like bad timing for the Democrats, if Roosevelt runs."

"Why do you keep saying 'if Roosevelt runs'," I persisted. "Won't they be just as mad if he doesn't?"

"Well, they are very proud of Judge Cordell Hull down there," he explained, "and it so happens I hear more talk about Hull than anyone else if Roosevelt doesn't take it. But the real point is that they are blaming Roosevelt personally for their tax boosts, more than they are blaming Dave Lilienthal, or TVA in general, or the Democratic Party.

He Let Them Down

"For seven years, you see, they have been believing that Roosevelt was all powerful in Washington. Anything that Roosevelt wanted, they kept reading in the newspapers, was done. Nobody has told them any different. I don't know as anybody could.

"All right. With that point of view they watch the proceedings in Congress on this legislation to make the TVA pay the towns and counties as much as they lose in tax revenue, the taxes the private utilities used to pay. They see only a trickle instead of the golden flood they used to get. And they blame Roosevelt. If he had wanted to help them, they figure, he could have done it.

"And it's going to take a powerful lot of fireside hypnotizing to get them over being mad."

There is no desire on the part of the writer to predict that Tennessee will go Republican this fall. Nor will there be any "I told you sos" in midsummer if Knox county, which includes Knoxville and TVA headquarters, goes G.O.P. with a bang in its local election. It did four years ago. It generally does.

But this sort of talk cannot help being impressive when one considers how desperately the Administration press agents are trying to make the "public utility magnate" issue stick against Willkie.

Dismay Among New Dealers

Here are the two states which probably have benefited most of the entire 48 from Federal power spending, Tennessee and Oregon, both in bad shape from the Administration viewpoint. Tennessee because of dissatisfaction over the tax results, and Oregon because its political hero, Senator Charles L. McNary, is Willkie's running mate.

In the April 20 issue of ELECTRICAL WORLD, this writer discussed the Willkie candidacy. This is not referred to with pride, because I never dreamed such a ground swell of sentiment from the grass roots would overwhelm the Philadelphia convention. But stress was laid in that article on the point that ALL the attacks on the electric industry have been made. Nothing new CAN be brought up. It just isn't there. Whereas the defense of the industry, while it has been made also, has never been offered by someone who could make himself heard above the tumult of voices raised in an attack against business.

Willkie can make himself heard above that shouting.

The New Dealers know it, and, as predicted in that April 20 article, they are not pleased at all with the notion of a campaign on the merits of public versus private ownership of the electric business. That is, nobody except John Rankin. Even George Norris sadly admits that nobody except Roosevelt could possibly beat Willkie!

NEWS OF THE WEEK

Turbine Order Volume Starts Priority Talk

Defense committee sees need within 30 months for five million hp. of turbines for warships — Priorities anticipated but effective dates depend on volume of utility orders

Exclusive from Washington Bureau of ELECTRICAL WORLD

Government priority regulation in filling orders for large turbines and maybe small ones, too, is coming sooner or later, as part of the nation's national defense program. The reason is traceable directly to the Navy's tremendous shipbuilding program which will bring this service branch into the already crowded turbine market as the biggest and most insistent customer.

5,000,000 hp.

Within 30 months, warships for which contracts already have been awarded will need turbines of a total capacity of nearly five million horsepower. This does not include additional ships authorized by the Vinson 70 per cent expansion bill, for which funds are not yet appropriated. The larger program is planned over a seven-year period, which means the present demand is only the beginning. This huge demand upon a highly specialized and limited industry is attracting prime attention of the defense commission, it is said, particularly of Admiral Emory S. Land who already is said to have experienced trouble obtaining turbines and allied equipment as fast as he wanted it in his capacity as chairman of the U. S. Maritime Commission.

That priorities will be required for turbine distribution is already being taken for granted at the defense commission; the big question, as yet unanswerable, is when.

Wishful Orders

Defense Commission spokesmen say the answer will depend in part at least, upon the electric industry. If power companies, fearing a shortage, jam the market with "wishful" orders, priorities will come sooner; if the utilities heed the dictum of the commission's production chief, W. S. Knudsen, that "when you need two of an article, don't order three hoping to get two," then priorities will be delayed, it is said.

All this may have the effect of putting electric utilities "on the spot." New Dealers still harp about impending power shortage in the defense program and continually promote new and grand schemes for solution of these paper problems, some of them calculated to prod the industry into expanding generating construction programs. Now comes the Defense Commission with urgings that only turbines which are vitally needed be ordered.

If—or when—priorities for turbines are instituted it is a safe bet that the Navy will get first call on whatever it wants. This will be limited only by whatever localized power problems might develop when defense order production swings into high gear.

Authority for Priorities

Present legislative authority is ample it is said for the President to order priorities, at least on all orders on which production has not been started. Whether the government can now commandeer a turbine being produced for one customer and order it sent elsewhere is debatable but legislation to permit this is being drafted. To get an idea of the volume the Navy will need for its fleet expansion here are some figures of turbine ratings on fighting ships: Battleships use turbines generating a total of from 100,000 to 180,000 horsepower. There are eight under contract, all for delivery by the summer of 1944 and for which turbine orders are not yet placed.

Aircraft carriers use 120,000 or more horsepower. There are four under contract, with no turbine sub-contracts let yet, with delivery called for by the fall of 1943. Cruisers are rated at around 100,000 horsepower. Fifteen of these are now under contract, have not had turbine equipment installed, and delivery of all is scheduled by the spring of 1943. Destroyers use around 40,000 horsepower and there are 40 on the contract books needing turbine equipment by the end of 1942.

Submarines are diesel-powered. The Navy now has practically gone over 100 per cent to boilers of a minimum of 600 lb. pressures. It is experimenting with boilers of up to 1200 lb. pressure in some of its newer ships, with the tendency toward higher pressures to provide greater speed becoming increasingly pronounced.

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Montaup Orders New G. E. Topping Turbine

To increase its generating capacity and obtain improved economy, the Montaup Electric Co., Somerset, Mass., has ordered a General Electric 1800-lb.-pressure turbine-generator unit for installation in its present plant. This unit will be suitable for carrying loads up to 25,000 kw. and will be superposed on two existing low-pressure units having a combined capacity of 76,000 kw.

The design of the new high-pressure plant calls for supplying steam to the topping turbine at 1800-lb. gage pressure and 950 deg. F. total temperature at the throttle, and exhausting it at 400 lb. gage pressure.

After boiler reheat to 750 deg. F.

total temperature, the steam will go to the present 375-lb. station mains and finally to the present low-pressure turbines. The unit will run at 3,600 r.p.m. and the generator will be hydrogen-cooled.

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Atlanta Station to Double Its Capacity

Georgia Power Co. has ordered a G-E 60,000-kw. turbo generator to be installed next year in Plant Atkinson at Atlanta, Ga. Present equipment at the plant consists of a 60,000-kw. G-E unit installed in 1930, so the new turbine will double the capacity of that station.

The new turbine is a 17-stage unit of the condensing turbine generator type with surface air cooler. It will operate at 1,800 r.p.m. and drive a 66,667-kva., 13,800-volt, 60-cycle generator. It is designed for steam conditions of 425-lb. pressure and a temperature of 725 deg. F. and 2 in. absolute back pressure.

Georgia Power Co. decided to double its capacity at Plant Atkinson because of the growth of the company's load in and around Atlanta and to bring about more flexible load balancing.

INSPECT SWITCHGEAR — Vertical lift metal-clad switchgear for the University of Illinois' new power house is inspected by (l. to r.) J. D. Greensward, assistant manager, switchgear division, Allis-Chalmers; K. L. Tate, Taylor Instrument Co., Rochester, N. Y.; J. E. Schoen, dean of mechanical engineering, Marquette University, Milwaukee, and F. C. Ludington, switchgear engineer, Allis-Chalmers. This equipment was on display at the West Allis works of Allis-Chalmers Co. during the A.S.M.E. convention in Milwaukee

Westinghouse Organizes for Defense Production

Board Chairman Robertson rejects "hit-and-miss" solutions of industrial preparedness—Presents survey of company's war facilities to Roosevelt and Knudsen.

Results of a complete survey undertaken by Westinghouse Electric & Manufacturing Company to determine what it could do in production of national defense materials were outlined to President Roosevelt and William S. Knudsen at Washington by A. W. Robertson, Westinghouse's Board chairman. Asserting that he took the initiative in going to Washington with the survey, Mr. Robertson said: "We looked ourselves over and decided what we could do. We think that if large industrial concerns would survey what they can do and place this information before the Government, the whole production capacity of the country would be immediately available. There would be no fishing around and no hit-and-miss stuff."

Emergency Division

Currently Westinghouse is engaged in the manufacture of naval and military products such as propulsion and other equipment for naval vessels, radio apparatus for aircraft and miscellaneous material. These are products Westinghouse is adapted to manufacture and Mr. Robertson said, moreover, an "emergency products division" has been set up to coordinate all the new activities and speed the program.

Other steps already undertaken by Westinghouse include: establishment of an organization in Cleveland which will both design and manufacture new tools; a survey of all the company's present tool facilities to determine that equipment in excess of regular production requirements; an investigation proceeding in Pittsburgh and other industrial areas to determine where machine tools can be obtained for emergency production; tool makers and designers being employed as rapidly as possible; a training program soon to be started for skilled mechanics and machine operators; retired employees who are available to be re-employed on part or full time to serve as instructors.

Time to Prepare

People do not seem to realize, Mr. Robertson stated, that it takes time to prepare industries for mass production. Believing industry generally is in the same position as his company, Mr. Robertson described the Westinghouse situation as requiring a year before it could produce any great quantity of finished products. "At the end of a year," he said, "we'd be ready for mass production and at the end of two years we'd be going great guns.

"Just to show how long it takes to get ready to make something we have been ordered to get ready to make gun mounts. It will require at least four months just to prepare to manufacture this item."

It is all very well to talk of 50,000 airplanes a year and other elements of defense goods, Mr. Robertson stated, but added: "We'd be very foolish to think we can produce these things by just turning an automobile plant around and running it in reverse and getting battleships or airplanes off the assembly lines."

Highest Backlog

Westinghouse does not want war business, said Mr. Robertson. The backlog of unfilled orders is now higher than at any time in the history of the company. The company's plants have been extremely busy for many months manufacturing electrical equipment for peace time uses.

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Transmission Additions

Wisconsin Public Service Corp. will make additions to its transmission lines between Green Bay and DePere and to its substation in the latter city at a total cost of about $144,000. Approximately $51,000 will be spent on the transmission lines, $91,000 on switching and substation facilities and $22,000 for right-of-way.

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"No Down Payment" Plan Unnecessary, says Mart

Installment men attending National Retail Furniture Association divisional meetings in Chicago have announced that maximum financing terms on electric appliances should be held below 30 months, and that "no down pay-

ment" selling should be discouraged.

Recalling the punctured prosperity of 1937, installment men do not minimize the importance of a huge Federal defense spending program. On the other hand it was said, a Hitler triumph over Great Britain might mean an "exceedingly troubled time" as cancellations of British orders would disrupt employment until our own defense volume took up the slack.

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New York Parkway Gets Sodium Lights

Probably the world's largest and longest sodium safety lighting system was turned on last week as New York dedicated its newest highway, the 33-mile Belt Parkway running from Owl's Head Park in Brooklyn to the Bronx-Whitestone bridge in Queens.

More than 2,200 sodium lights of a type developed by General Electric engineers are used. The sodium luminaires employ airplane-shaped reflectors and use 10,000-lumen lamps in a horizontal position. They are mounted about 23 feet above the pavement on cedar poles spaced about 150 feet apart along the divided parkway.

Incandescent lights, with orange-colored glass globes (to harmonize with the sodium lights) and 230-watt bulbs are installed in the ceilings of the underpasses along the parkway. The installation was made under the supervision of Nicholas J. Kelly, Chief Engineer of Light and Power in the city's Department of Water Supply, Gas and Electricity. Mayor La Guardia initiated the sodium lighting for the parkway, Mr. Kelly said, after studying a similar installation in his home town of Prescott, Ariz.

North American Prepares for Defense Peak Loads

Increased program of power plant construction calls for 110,000 kw. over and above 270,000 kw. of additions announced in January — Cleveland and Washington, D. C., involved

Power plant construction more than 40 per cent in excess of that originally scheduled, bringing proposed electric generating capacity additions to 380,000 kw., was assured national defense authorities last week by E. L. Shea, president North American Company.

In a letter to Gano Dunn and Leland Olds, members of the recently set-up subcommittee of the National Defense Advisory Committee on electric power, Mr. Shea called attention to the system's $61,000,000 construction program, which included 270,000 kw. capacity and was announced last January. The stepped-up program calls for an additional 110,000 kw., bringing the total construction to about $90,000,000, including cost of all utility facilities. Mr. Shea said the system's capacity of 2,128,000 kw. exceeds by one-third the present peak demands made on it so far.

Two 60,000-Kw. Units for Cleveland

Details of the increased construction program were revealed in Cleveland and Washington, D. C., where Cleveland Electric Illuminating Company and Potomac Electric Power Company, respectively, will double their present power plant construction programs.

At Cleveland, where plans called for a 60,000-kw. turbo-generator to be ready for operation in the new power plant on Lake Front Road in May, 1941, a second 60,000-kw. unit will be ordered, for installation about a year later, according to President Eben G. Crawford. Completion of this program will increase the utility's capacity about 25 per cent.

No additional boiler capacity is needed, since original plans for the plant included two boilers, each enough to operate a 60,000-kw. turbo-generator. The plant will operate with steam at 900 deg. and 850 lb. Boilers will convert water into steam at the combined rate of nearly 11 tons per minute and will be equipped with electric precipitators. The plant will be interconnected with the company's Lake Shore, Avon and Ashtabula plants.

Cost of the second generator will be $1,900,000, bringing total cost of the new power plant up to $8,200,000. Cleveland Electric Illuminating has filed an application with the Securities and Exchange Commission for issuance and sale of $50,000,000 of 3 per cent first mortgage bonds, series due 1970, proceeds of which are to be used for refunding and new construction. Hearing has been set by the SEC for July 16.

Buzzard Point Addition

At Buzzard Point plant of Potomac Electric Power, where a 50,000-kw turbo-generator is scheduled to go into operation in October, 1940, a second

33 MILES OF SODIUM—New York City got one of the world's largest and longest installation of sodium lighting last week as it dedicated the 33-mile Belt Parkway. Airplane-shaped reflectors house 10,000-lumen sodium lamps. Boxes are used for visibility tests

50,000-kw. unit will be ordered for installation by February, 1942, according to President A. G. Neal. These two units will make a total capacity of 390,000 kw. available to the system, including 35,000 kw. available through tie-lines to hydro-electric sources on the Susquehanna River.

The orders for new machinery consist of a turbo-generator, boilers, pumps and condensing equipment. Housing for the second unit is already provided in the plant addition under construction.

Potomac Electric Power has filed with the SEC for a proposed private sale of $10,000,000 of 3¼ per cent first mortgage bonds, due 1974. Proceeds, together with other company funds, would be used to maintain normal capital working requirements and to meet normal construction expenditures during the rest of 1940 and 1941.

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"American Primer" Suggested by Reed

With the impact of war abroad now strongly felt here in America, where people have an average schooling of seven years, an "American Primer of Self Government" is needed, Philip D. Reed, Chairman, General Electric Co., last week told members of the Sales Executive Club of New York.

Essential elements of such a primer would consist of the following, said Mr. Reed: (1) The American Constitution should be studied, respected and revered; (2) we should keep distinct the legislative, judicial and executive functions of our government; (3) we should remember that government belongs to the people, that government is inherently inefficient in the conduct of business affairs and that therefore its activities in the sphere of business should be limited; (4) we should be vigilant for freedom of speech, freedom of worship and freedom of action; (5) we should cherish our system of free enterprise which gives every man the right to work where he pleases, when he pleases and for whom he pleases at a price to be arrived at freely; (6) we should respect thrift and economy and beware of debt; and (7) above all, we should learn to scrupulously keep our word.

The next five years will probably see a struggle between democracy and dictatorships, Mr. Reed stated, and there will have to be continued cooperation between business and government to achieve our defense programs. Our ability as a nation to do this will be a challenge to free enterprise, Mr. Reed stated, and it will mean that we shall have to sell the American way of life to Americans. The social advances which we have made in the past few years are laudatory, he said, but we must always keep in mind the fact that they cost money. The money comes, in the last analysis, from American business. Therefore if we are to safeguard our social advances, then American business and the American system must be maintained and vigorously supported.

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Harrison Appointed to Defense Advisory Post

W. H. Harrison, vice president and chief engineer of American Telephone & Telegraph, has been appointed director of the construction division of the production department of the National Defense Advisory Commission.

Recently president of the AIEE, Mr. Harrison is well known to utility men also through his work on joint ownership of distribution facilities and on early joint committees of the National Electric Safety Code.

MEETINGS

International Association of Electrical Inspectors—Annual meeting, southwestern section, Santa Barbara, Calif., August 26-30; northwestern section, Great Falls, Mont., September 3-6; southern section, Houston, Tex., September 16-20; western section, Kansas City, Mo., September 23-27; eastern section, New York, N. Y., October 7-11.

American Institute of Electrical Engineers—Pacific Coast convention, Los Angeles, Calif., August 27-30; Middle Eastern district meeting, Cincinnati, Ohio, October 9-11; winter convention, Philadelphia, Pa., January 27-31. H. H. Henline, national secretary, 33 West 39th St., New York, N. Y.

American Society of Mechanical Engineers—Fall meeting, Hotel Davenport, Spokane, Wash., September 3-6; annual meeting, New York, N. Y., December 2-5. C. E. Davies, national secretary, 29 West 39th St., New York, N. Y.

Illuminating Engineering Society—Annual meeting. Essex and Sussex Hotel, Spring Lake, N. J., September 9-12. F. G. Horton, executive secretary, 51 Madison Av., New York, N. Y.

Rocky Mountain Electric League—Annual convention, Albuquerque, N. M., September 9-11. George Lewis, Manager, Gas & Electric Building, Denver, Colo.

Association of Iron and Steel Engineers—National convention, Chicago, Ill., September 24-27. Brent Wiley, managing director, Empire Bldg., Pittsburgh, Pa.

Indiana Electric Association—Annual convention, French Lick, Ind., September 25-27. R. E. Blossom, secretary, 1414 Circle Tower, Indianapolis, Ind.

Empire State Gas and Electric Association—Annual convention, Westchester Country Club, Rye, N. Y., September 26-27. George H. Smith, secretary, Grand Central Terminal, New York, N. Y.

Electrochemical Society—Fall meeting, Ottawa, Canada, October 2-5. Colin G. Fink, secretary, Columbia University, New York, N. Y.

National Electrical Wholesalers Association—Semi-Annual convention, Hotel William Penn, Pittsburgh, Pa., October 22-25. E. Donald Tolles, managing director, 165 Broadway, New York, N. Y.

National Electrical Manufacturers Association—Annual meeting, Waldorf-Astoria Hotel, New York, N. Y., October 27-November 1. W. J. Donald, managing director, 155 East 44th St., New York, N. Y.

N. Y. Edison Lauded for Appliance Drive

Before 1,200 dealers, distributors and salesmen gathered at a celebration luncheon in New York last Monday, Charles E. Wilson, president, General Electric Co., lauded the recent four-month appliance campaign conducted by Consolidated Edison Co. of New York. This campaign, said Mr. Wilson, is "an example of the type of national cooperation and unity needed in pushing through the nation's defense program as speedily and economically as possible."

Representative Bruce Barton and Vice-chairman Oscar H. Fogg, of Consolidated were other speakers, and tribute was paid to E. F. Jeffe, vice president in charge of sales, who headed the $5,000,000 drive. In recognition of this work, he was presented with a gold vacuum cleaner.

During the campaign, 375,000 vacuum cleaners, lamps and irons were sold to 130,000 residential customers. Mr. Fogg pointed out that employees' extra commissions on sales amounted to $60,000 and the city of New York derived $100,000 from sales taxes on the appliances.

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Cameron Made I.E.S. Head

The Illuminating Engineering Society has elected A. D. Cameron, vice-president of the Holophane Co., as its new president to succeed Lester H. Graves, vice-president of Curtis Lighting, Inc.

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John B. Garden Dies

John B. Garden, president of the Wheeling Electric Co. and a pioneer in the electric utility industry, died at his home in Wheeling, West Va., July 7, at the age of 80.

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Plan Interconnection for Bonneville Dam

One of six different channels outlined to secretary Harold L. Ickes by the Department of Interior whereby cooperation in defense measures can be undertaken involves interconnection of Bonneville and Grand Coulee.

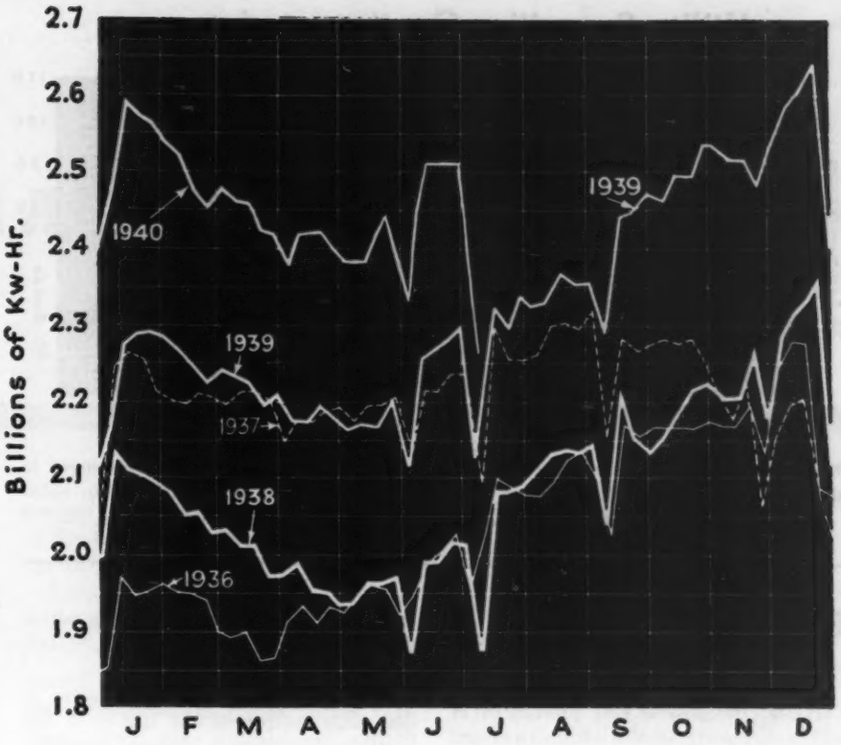
The Department's report calls attention also to the large force of engineers the technical services of which could be directed to defense problems, and also to large numbers of heavy trucks and other motorized equipment.

Record Output Drop During Holiday Week

Independence Day cut the output of electricity in the week of July 6 to 2,264,953,000 kw.-hr., according to the Edison Electric Institute, smallest production since the corresponding week of last year. Output, however, was still 9.0 per cent ahead of this week of July 8, 1939, 20.4 per cent ahead of the corresponding 1938 week and 8.1 per cent ahead of the 1937 week.

The decrease in this holiday week from the preceding week was 9.9 per cent, sharpest drop on record for such a period. It compared with a decrease of 9.7 per cent in the corresponding week of 1939, when July 4 fell on Tuesday, with a drop of 6.1 per cent in 1938, when Independence Day was on Monday, and with 6.4 per cent in 1937, when the holiday came on Sunday. For the week of July 6, output was 14.2 per cent below last winter's all-time peak.

Three geographic regions showed higher percentage gains over a year ago; the 32.7 per cent gain for the Rocky Mountain area was the largest since the week of April 17, 1937.



Weekly Output Millions Kw.-Hr.

1940		1939		1937	
July 6	2,265	July 8	2,078	July 10	2,096
June 29	2,514	July 1	2,300	July 3	2,238
June 22	2,509	June 24	2,285	June 26	2,238
June 15	2,516	June 17	2,265	June 19	2,214
June 8	2,453	June 10	2,257	June 12	2,214
June 1	2,332	June 3	2,114	June 5	2,131

Per Cent Change from Previous Year

	Week Ending		
	July 6	June 29	June 22
New England	+ 1.8	+ 7.0	+ 5.1
Middle Atlantic	+ 4.5	+ 6.1	+ 6.0
Central Industrial	+12.1	+13.4	+14.9
West Central	+ 3.6	+ 4.3	+ 8.1
Southern States	+ 9.3	+ 8.1	+ 7.7
Rocky Mountain	+32.6	+21.7	+21.8
Pacific	+ 9.9	+ 6.9	+ 7.7
United States	+ 9.0	+ 9.3	+ 9.8

3% More Customers Use 13% More Energy

During April, 1940, 29,367,025 ultimate customers of the electric light and power industry (3.1 per cent more than in April, 1939) bought 9,269,897,000 kw.-hr., 12.5 per cent more than in April last year, for which they paid $194,414,600, or 6.1 per cent more than in the same month a year ago, according to the Edison Electric Institute.

While the number of rural customers (those on distinct rural rates) showed an increase of 12.9 per cent for April, 1940, over April, 1939, sales to this group showed a decrease of 1.2 per cent—first decrease this year. Evidence of increasing industrial activity was reflected in the large light and power classification, 3.4 per cent fewer customers using 18.6 per cent more energy in April, 1940, than in April, 1939.

For the twelve months ended April 30, average residential consumption was 916 kw.-hr., average annual bill was $36.09, or a rate of 3.94 cents per kw.-hr. These figures represent increases of 5.4 and 1.5 per cent, and a decrease of 3.7 per cent, respectively, compared with the corresponding period of 1939.

Classification of Sales, April, 1940, and Change from 1939 (Revised Series)

	Million Kw.-Hr. 1940	1939	% Change
Residential or domestic	1,856	1,701	+ 9.1
Rural (distinct rural rates)	124	125	— 1.2
Commercial or industrial			
Small light & power	1,758	1,635	+ 7.5
Large light & power	4,611	3,889	+18.6
Street & highway ltg.	155	152	+ 1.7
Other public authorities	221	204	+ 8.1
Railways & railroads			
Street & interurban rwys.	326	324	+ 0.1
Electrified steam rrs.	156	151	+ 3.6
Interdepartmental	63	62	+ 3.1
Total to ultimate customers	9,270	8,243	+12.5

•

Output Gains 12% in May Over Year Ago

Production of electric energy for public used during May was 11,428,552,000 kw.-hr., an increase of 12.3 per cent over May, 1939, according to the Federal Power Commission.

Average daily production during May was 368,663,000 kw.-hr., or 0.5 per cent more than the average daily production in April. Production by water power amounted to 40 per cent of the total output for public use, as compared with 41 per cent in April and 41 per cent in May a year ago. For the twelve months ended May 31, output totaled 134,459,000,000 kw.-hr., 13 per cent more than in the previous year.

Reports received during June, 1940, indicated that the capacity of generating plants in service in the United States on May 31 was 40,646,000 kw.

•

Lets Substation Contract

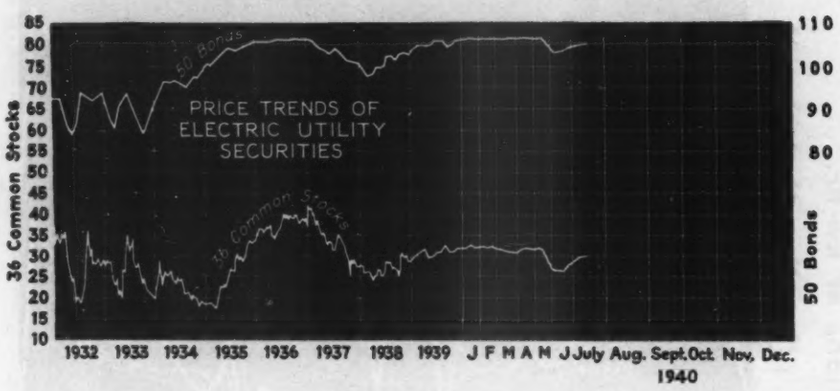
Contract for constructing a 7,500-kw. step-down substation for the Kendrick project power system has been let by Secretary Ickes.

•

Correction

An error in writing captions for ELECTRICAL WORLD's report of the A.S.M.E. Milwaukee convention in the June 29 issue placed Alex Bailey in the employ of the Detroit Edison Company. Mr. Bailey is with the Commonwealth Edison Company, Chicago.

Utility Securities Continue to Improve


PRICE TRENDS OF
ELECTRIC UTILITY
SECURITIES
50 Bonds
36 Common Stocks
36 Common Stocks
50 Bonds
1932 1933 1934 1935 1936 1937 1938 1939 J F M A M J July Aug. Sept. Oct. Nov. Dec.
1940

Electric utility securities moved within narrow margins to slightly higher positions in the week. "Electrical World" index of stocks moved upward from 28.7 to 29.0; index a year ago, 30.6. Bond index rose from 102.2 to 105.5; index a year ago, 105.7

Byllesby Gives Up Standard Holdings

H. M. Byllesby & Co., prominent in utility financing in the 1920's, has announced its intention of relinquishing for cancellation 330,000 shares of common stock, Class B of Standard Power & Light Co. which it holds. An order has been approved by the SEC whereby Standard Power & Light Co. will acquire without the payment of any consideration the 330,000 shares or 75 per cent of the issue.

A contract is to be executed between Standard and Byllesby by the terms of which Byllesby would be entitled to receive upon any distribution of the assets of Standard Power "the proportionate share of the assets of the corporation to which the holder of the 330,000 shares would have been entitled had they not been surrendered."

The SEC points out that the Byllesby Company has owned more than 10 per cent of the voting securities of Standard Power and therefore, under the provisions of the holding company act of 1935 is a *prima facie* holding company. By giving up its stockholdings, the Byllesby Company avoids the necessity of registering as a holding company.

•

Property Records Requested of PP&L

Pennsylvania Power & Light Co., with principal offices at Allentown, was given until Aug. 1 by the Public Utility Commission to submit the last of its "continuing property records," looking toward a new permanent rate order.

The company, which serves 28 central and eastern Pennsylvania counties, has been operating since Dec., 1938, under a temporary rate order in which the commission required a $2,300,000 annual rate cut.

The Public Utility Commission at that time instructed the utility to file monthly "continuing property records" which will be taken into account in determining whether the company has obtained revenues in excess of 6½ per cent allowed under the utility law, and may be required to make further rate reductions.

The company, Richard J. Beamish, a commission member, said, had asked an extension "until the end of the year."

•

Re-elect Jerome N. Frank

Jerome N. Frank has been unanimously re-elected chairman of the Securities & Exchange Commission for the fiscal year ending June 30, 1941. He was appointed a member of the commission on December 20, 1937, to fill the unexpired term of James M. Landis, and was elected chairman in June, 1939.

•

Minnesota Units File Merger Plan with Board

Northern States Power Co. of Minnesota, together with its wholly owned subsidiary, the Minneapolis General Electric Co., and the latter company's two wholly owned subsidiaries, the St. Croix Falls (Minn.) Improvement Co. and the Minnesota Brush Electric Co., have filed with the SEC an application regarding a proposed merger of their properties and assets in a program which would eliminate three.

Companies to be dissolved would be the Minneapolis General Electric, St. Croix Falls Improvement and Minnesota Brush.

SEC Speeds Plan on Integration Hearing

The Securities and Exchange Commission has decided that a formal interpretation of the meaning of geographical integration, Section 11 (b) 1 under the so-called "death sentence" provision is needed in a hurry. A hearing will be arranged to this end, probably for the week of July 21, using whichever case of the nine pending that can be whipped into shape.

Original conversations were with Middle West Corp., but both the industry and SEC's public utilities division contended the issue is not clear-cut enough in that case. Possibility is that no "guinea-pig" case will be used, that the SEC instead will call a round-table hearing at which all companies would be invited to discuss their views.

Real reason SEC is in such a hurry to interpret geographical integration apparently stems from difficulty of fulfilling its promise to give four systems tentative "blueprints" of how to integrate, without first clearing up ambiguities in that provision.

•

Thirty Witnesses Detail "Kick-backs" at St. Louis

Upward of 30 witnesses have appeared in U. S. District Court at St. Louis to testify before SEC examiners regarding an alleged "political slush fund" built up by Union Electric of Missouri from currency kick-backs.

At the beginning of this week approximately $526,027 of kick-backs had been traced through testimony elicited from attorneys who were on a retainer basis, insurance agents in the company's territory, electrical apparatus salesmen, supply house representatives and insurance company officers in charge of blanket policies for automobile, burglary, public liability and plate glass insurance.

Utility Reports

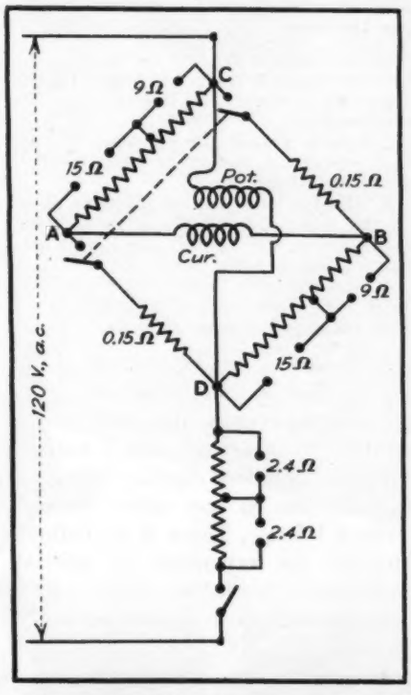
	Net Income 1940	1939
*Alabama Power	$3,716,667	$3,873,314
*Arkansas Power & Light	1,167,439	1,401,399
*Consol. Gas Elec. Lt. & Pwr. (Balti.) and subs.	6,840,012	6,156,605
*Consumers Power	10,491,083	9,073,296
*Georgia Power	4,498,758	5,374,124
*Louisville Gas & Electric (Ky.) and subs.	3,073,200	2,644,144
*Northwestern Electric	557,382	495,741
*Ohio Edison	4,159,961	4,126,926
*San Diego Consol. Gas & Elec.	1,478,747	1,487,422
*Texas Electric Service	1,580,920	1,061,971
*Wisconsin Public Service and sub.	1,788,540	1,537,461

*Twelve months ended May 31.

OPERATING PRACTICES

Co-ordination Kit ChecksRelayOperation

For making routine and acceptance tests on directional overcurrent relays to be used on its transmission system, Commonwealth Edison Company test engineers use a "co-ordination kit" of their own design that has been developed in the company's testing laboratories. This kit produces, artificially, the condition of simultaneous high current and reverse flow encountered in the case of a fault on one line of a transmission loop connecting several substations. It is used to insure that the relay directional and overcurrent contacts operate in the proper sequence on application and removal of the fault and that they do so without bouncing or chattering.



CIRCUIT CHECKS operation sequence of contacts on directional overcurrent relays

Referring to the accompanying diagram of the co-ordination kit, the current elements of the relay are connected across points A-B and the potential elements across points C-D. Then, with the double-pole switch open and 120 volts impressed across the input, a limited current flows through the high resistance path C A B D and both directional and overcurrent contacts remain open. When the double-pole switch is closed, however, a low-resistance path is established, so that a higher current flows in the path C B A D. Thus, the flow in the current element is both reversed and increased.

Constants of the circuit are selected to give the desired range of currents for the range of relay setting in use and the entire kit is mounted in a compact kit, with the terminals and switches brought out to a proper connection block.

Mobile Substation Has Metering, Too

By T. M. REED

Engineering Assistant Ohio Public Service Company, Lorain

In the two years since its construction our mobile substation has been useful in carrying load during rearrangement of transformers, especially since some of our secondary is being cut over from 120/240 volts, single phase and 240 volts, three phase, to 120/208 volts, three phase, four wire. Metering equipment on the unit has obviated the necessity for connecting and disconnecting meters and wiring at each installation. It has also eliminated loss of revenue and the unsatisfactory method of estimating kilowatt-hours and demand during a short period of temporary service.

The frame of a 1925 White chassis was cut down to 12 ft. 6 in. and the front wheels and springs with the

Atop primary cabinet (at right) are coiled leads for connection to utility's 2,400/4,160 Y-volt, 60-cycle primary supply. Secondary cabinet (at left) houses demand and kw.-hr. metering equipment and secondary terminal board, where connections can be made with bus straps to obtain, from three 25-kva. transformers, these combinations: 25, 50 or 75 kva., single phase, 120/240 volts, three wire; 75 kva., three phase, 240 volts, three wire; 75 kva., three phase, 120/208 volts., four-wire. Channel iron tongue attaches to line truck.

MOBILE SUBSTATION for emergency and temporary service built for $685, less transformers

steering mechanism reinstalled. The framework was made from small channel iron and, except for the ends, covered with steel screen. On each end was installed a Superior cabinet to house the meters, secondary connections and primary cut-out. Red lights, installed in moisture-proof fixtures on the left side front and rear and connected to one transformer, serve as night lights when the station is parked on the street and also indicate when the station is energized. All wiring was carried into the two cabinets in conduit.

Above each cabinet on the framework were installed four clevis insulators for dead ending the primary and secondary wires from the overhead line. High-voltage wires, sufficiently long enough to reach any pole top, were extended continuously from the primary cut-outs in the front cabinet, through condulets to the dead-end insulators on the framework. The end of each high-voltage wire was fitted with a hot line clamp. Lightning arresters were installed on the front end and connected to the primary just before it entered condulet. The arrester ground, primary and secondary neutral are securely bonded to the framework and the entire substation is grounded to an existing pole line ground or water system when the unit is in use.

Designed in our engineering department under the author's supervision, the mobile substation was constructed by the maintenance department under the supervision of F. C. West.

•

Precision Instrument Vibration Minimized

The vibration of the laboratory standard meters in the Standardizing Laboratory of the Central New York Power Corporation, Syracuse, N. Y., has been reduced to a minimum in a simple, inexpensive manner. Ordinary glass sockets (as used with furniture casters to guard against marring floors) are placed on small disks of rubber so that the mounts will not skid on the table top. Pieces of rubber sponge are cut to fill the glass sockets to the upper rim. The legs of the instruments rest on washers placed atop the sponge rubber. These washers are about ⅛ in. smaller in diameter than the glass.

Cable Installation Truck and Trailer

By M. W. GHEN
Superintendent Downtown Division,
Duquesne Light Company, Pittsburgh, Pa.

For the past three years the Duquesne Light Company has used with success a special truck and trailer combination for underground cable installation. Before designing this equipment a large truck capable of carrying a 4- or 5-ton cable reel, as well as tools and crew members, had been used. This truck was unwieldy for use on city streets; it was slow and expensive to operate.

In designing the new unit much consideration was given to the truck weight, its flexibility and safety features. It is equipped with storage space for tools and separate compartments for small material necessary for the work. Ladders, jacks, skids and other large equipment are carried on special racks. The truck is only partly covered, which permits carrying a light-weight (1-ton limit) reel on the back of the truck. The uncovered space is also used for hauling an empty reel on cable replacement work when the replacement cable is carried on the trailer.

The covered part of the body houses a 10-ton drum winch equipped with 600 ft. of 25,000-lb., $\frac{9}{16}$-in. wire and driven from the truck engine through a power take-off. Folding seats provide space for the crew when traveling. A curtain closes the rear of this portion of the truck in bad weather.

Trailer is built with a low body to allow easy loading and unloading. Its width is less than that of the truck, to facilitate parking on city streets. Air braking and lighting are supplied from the truck. A hand brake is provided on the trailer for parking. The heavy storage battery on the trailer provides parking lights and convenience outlets for connection of extension cords for night work. The trailer platform is supported on heavy coiled springs placed on the chassis. This feature did much to allow a minimum in over-all dimensions. A hand-operated winch mounted on the trailer chassis is used for raising and lowering loads in the absence of the truck. Skids for the trailer are carried on special racks at the side of the chassis.

•

Pole-Pulling Method for Those Rush Jobs

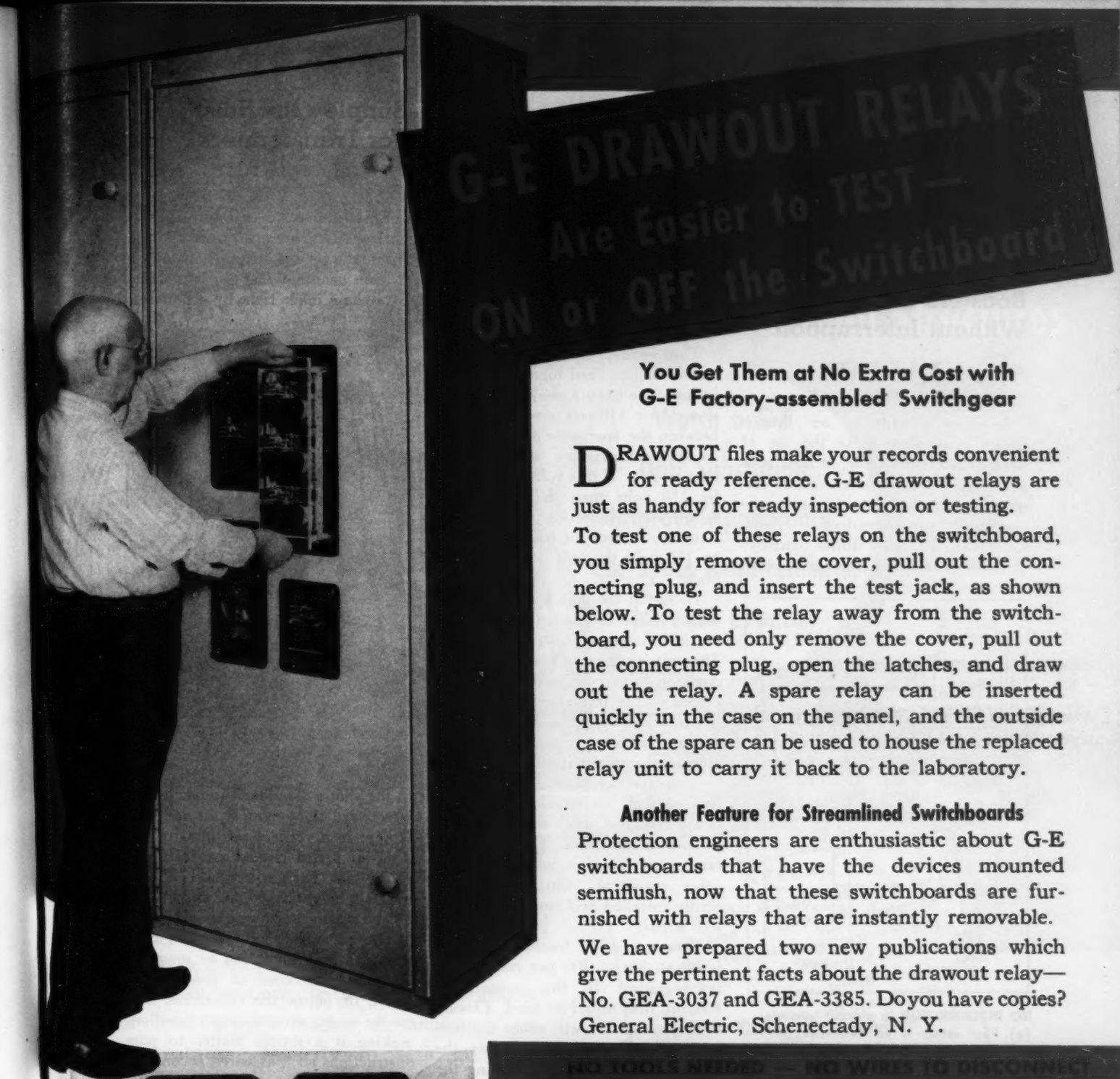
By RUSSELL DAVIS
Bridgewater, Mass.

When it is desirable or necessary to take out old poles in a hurry with a minimum of man-power and equipment this "bull rope" method has proved as easy as it sounds. Here are the steps:

1. About half way up the pole to be removed attach a heavy bull rope. Tie the other end to power; i.e., line truck or service wagon.
2. Loosen ground around base of pole until it can be rocked by hand over to about an 80-deg. angle.
3. Affix two pike poles at the same point on the pole. Ground the pikes so their shafts are at a 45-50-deg. angle, with the rope pulling between them.
4. Now pull with power. Easy tugs will do it. Out hops the old stick like somebody taking off from a ski jump.

In country districts, and where the top of the line won't foul with existing line too readily, this method can be done by one man with a helper. There is also less digging with this method than in any other removal method I know. There is no tedious jacking, no expensive or special equipment (such as pole jack) needed. The pikes should be fairly

COMBINATION OF TRUCK (15,000 lb. gross weight) and trailer (5 ton capacity) for underground cable installations



You Get Them at No Extra Cost with G-E Factory-assembled Switchgear

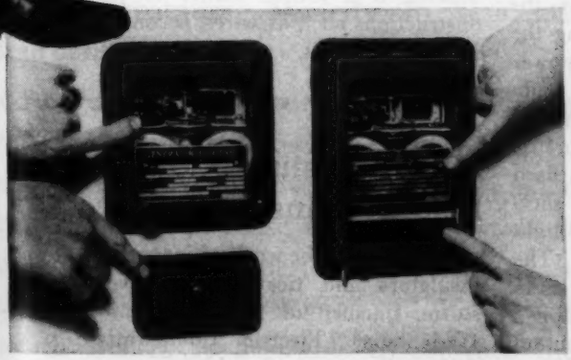
DRAWOUT files make your records convenient for ready reference. G-E drawout relays are just as handy for ready inspection or testing.

To test one of these relays on the switchboard, you simply remove the cover, pull out the connecting plug, and insert the test jack, as shown below. To test the relay away from the switchboard, you need only remove the cover, pull out the connecting plug, open the latches, and draw out the relay. A spare relay can be inserted quickly in the case on the panel, and the outside case of the spare can be used to house the replaced relay unit to carry it back to the laboratory.

Another Feature for Streamlined Switchboards

Protection engineers are enthusiastic about G-E switchboards that have the devices mounted semiflush, now that these switchboards are furnished with relays that are instantly removable.

We have prepared two new publications which give the pertinent facts about the drawout relay—No. GEA-3037 and GEA-3385. Do you have copies? General Electric, Schenectady, N. Y.



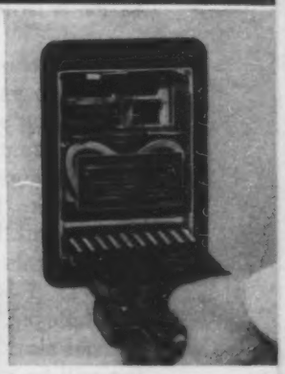
THE OLD WAY
Relay and testing facilities are separate. Space and wiring requirements are greater

THE DRAWOUT WAY
Relay and testing facilities are combined in one compact unit. Space is saved

NO TOOLS NEEDED — NO WIRES TO DISCONNECT

OFF WITH THE COVER

OUT WITH THE PLUG



IN WITH THE TEST JACK

GENERAL ELECTRIC

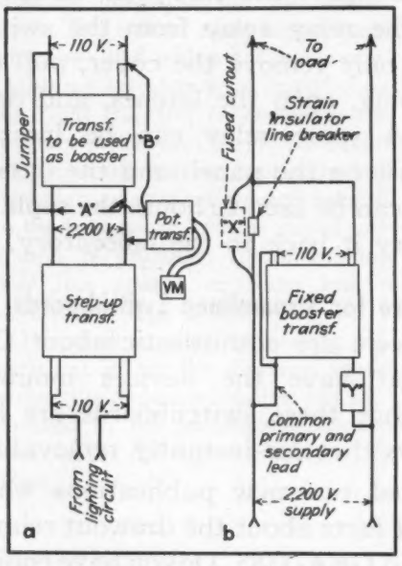
sturdy. In closely settled districts, or where there is a "mare's nest" overhead, the final pull must be more carefully executed and pike men are needed to stand by to let the stick down.

•

Boosters Connected Without Interruption

By L. F. YOUNG
Electrical Superintendent Ketchikan Public Utilities, Ketchikan, Alaska

Loading conditions on branch feeder lines often make the use of fixed boosters desirable, at least temporarily, at which time a small distribution transformer becomes the operating superintendent's friend. Ketchikan Public Utilities employs methods of selecting transformer size,



NO INTERRUPTION in placing boosters (a) First set-up is to determine relative polarity of secondary of booster. (b) Set-up for installing booster with position indicated for fused cutout, blowing of which places booster in service.

testing for connection, and actually connecting or disconnecting the units which have several advantages.

For example, assume a 2,200-volt line carrying 40 amp. is to be boosted 5 per cent. Five per cent of 2,200 volts equals 110 volts, which, at 40 amp., equals 4,400 volt-amperes or 4.4 kva. A 5-kva. transformer would be employed, being the nearest commercial size. As the secondary winding will be subjected to full line potential to ground or case, insulation tests should be made between secondary and ground, as well as between primary and secondary, and primary to ground or case.

To make sure that connections are correct for boosting, arrange to obtain primary potential within the premises where the booster is being installed by backing up a small distribution transformer. As shown in the accompanying illustration, connection *A*, the unit to be used as a booster is connected to this supply and this primary voltage is read.

Then connect one adjacent primary and secondary lead together, the secondary side having already been connected for 110-volt service. Voltage between the free secondary lead and its adjacent primary is noted (connection *B*). If this voltage is greater by 110 volts than the reading obtained with connection *A* the connections are correct for boosting. If less by 110 volts the unit is connected to buck.

To install the unit a section of the primary line is jumpered to permit the installation of a strain insulator. The unit is placed in position and the common primary-secondary lead connected to the line side of the strain insulator, as shown, and the free secondary lead is connected to the load side of the strain insulator. An expulsion-type cutout, *X*, fused to carry line current, is installed across the strain insulator, after which the solid jumper is removed. The remaining free primary lead is connected to another cutout *Y*, which is permanently installed and connected to the line wire.

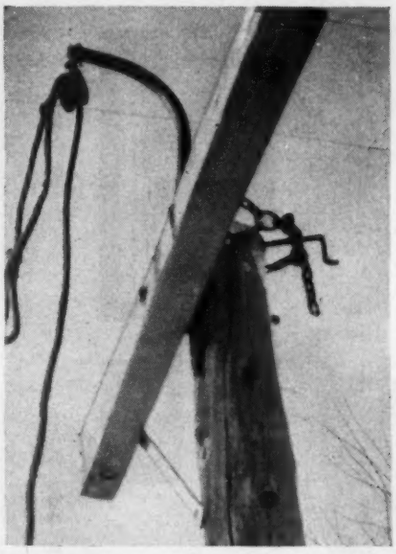
This cutout, if fused, should be fused at 200 to 400 per cent of the unit's rating. In this instance, a 10-amp. fuse would be used. Closing of this cutout, *Y*, will cause the fuse in cutout *X*, connected across the strain insulator, to blow, placing the booster in service without a power interruption. Removal of the temporary cutout, *X*, completes the installation.

Reversal of this procedure is used when taking the booster out of service, the cutout *Y* being fused as light as possible, or 100 per cent. The temporary cutout *X* is installed as in the first case, but this time is strapped so that when closed the fuse in cutout *Y* will blow, thus taking the unit out of service. A permanent jumper is next placed across the strain insulator and *X* removed, together with the booster unit, if not to be used again.

Simple Gin Hoist For Transformers

By J. KULICK
Oconto, Wis.

This gin may be used on vertical or horizontal type transformer settings. Inside the pipe is a steel shaft to keep it from bending. The gin is mounted by a chain made tight by a bolt bent



TRANSFORMER GIN simple to construct and easy to mount

to the shape of a small crank, which is screwed tight against the pole. It is kept in a vertical position by two 4 x 7-in. plates riveted on each side of the gin. The gin weighs 17 lb., its over-all height is 30 in. and it will hoist transformers weighing 150 lb.

The advantages of using a gin of this type are that it can be mounted on most any kind of pole, either above or below the crossarms, and can be swung around in any position, making it a simple matter to pass obstructions such as wires, secondary racks, crossarms, etc.

•

Mirror-on-stick Aids Insulator Inspection

To speed up the work of inspecting insulators and ties after a severe storm, linemen of the Kay County (Oklahoma) Electric Co-operative tied ordinary hand mirrors at an angle to the ends of fuse sticks. With the resulting tool, which resembled a large-scale dentist's mirror, the linemen, from below, could inspect the tops of insulators on the crossarms.

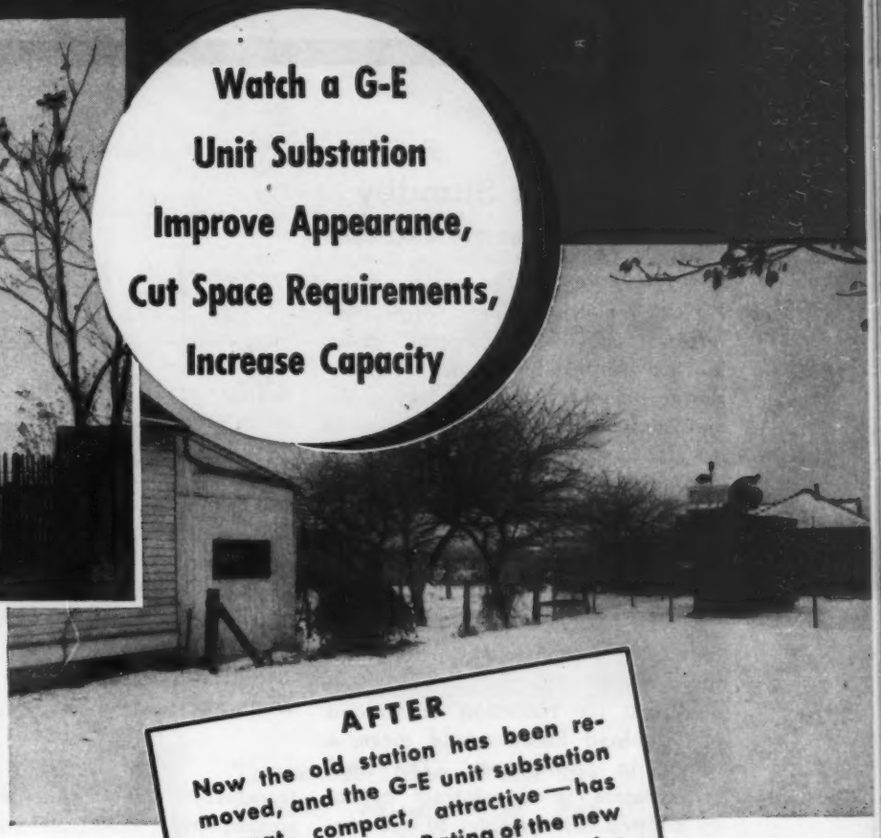
What an Improvement!

When Modern Unit Substations Replace the Old, Conventional Structures

BEFORE

Here's the old outdoor substation (supplying power to a suburban section in Louisville) just before it was dismantled. The new unit substation has already been set in place, and the top of the transformer is just visible behind the old structure

Watch a G-E Unit Substation Improve Appearance, Cut Space Requirements, Increase Capacity



AFTER

Now the old station has been removed, and the G-E unit substation —neat, compact, attractive—has taken over the job. Rating of the new station is 2000 kva, which is twice the capacity of the old station. (The brick house in the rear is not part of the electric substation)

THE trend is to modern, factory-assembled unit substations—for economy, flexibility, and attractive appearance. The Louisville Gas & Electric Company, for example, has a policy of replacing existing conventional substations with unit substations whenever load growth makes it necessary to increase substation capacity in residential or suburban areas.

And no wonder! With unit substations, expensive new construction is avoided. Their compact design makes possible the installation of additional capacity without an increase in the real-estate investment. The greatly superior appearance of the new stations builds customer good will. If future system growth makes it desirable to relocate the substation, it can be moved readily to a new location.

Find out for yourself how G-E unit substations can simplify system planning and cut costs for you. Write today for our new brochure GEA-2996, which contains the complete story. In addition to both single-circuit and multiple-circuit unit substations for permanent installation, it describes the new G-E portable unit substations for temporary installation or for emergency use. Address General Electric, Schenectady, N. Y.

GENERAL ELECTRIC

INDUSTRIAL ENGINEERING

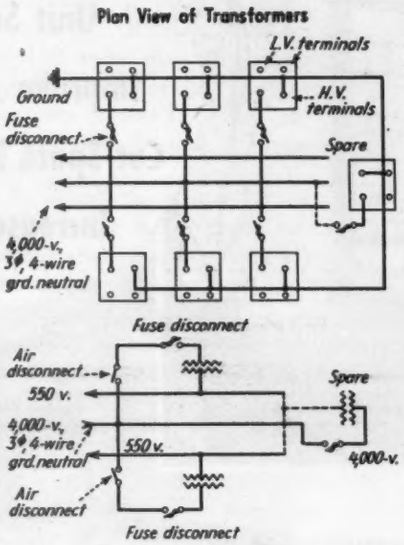
Economical Transformer Standby

By R. B. BRATTON and E. A. ANKENMAN
Westinghouse Electric & Manufacturing Company, Boston

As industrial plants grow, the greater becomes the difference under normal conditions between the transformer capacity needed during the day and on night loads. The need is also greater for standby transformer capacity and the ability to switch this in quickly.

This problem was solved by one plant whose anticipated planned load was about double the capacity of the available transformer bank. With purchased power being metered on the line side of the bank, it was evident that the reduction of no-load or light-load losses would mean a saving in power cost. The final arrangement in transformer capacity allowed the customer to cut one-half of the total capacity from the line at night, thus saving iron and copper losses; fuse one extra transformer with one-sixth the total capacity as a stand-by unit, and keep the existing transformer bank as part of the supply to the distribution system.

The existing distribution system was 4,000 volts, three phase, four wire, with grounded neutral. The transformer bank consisted of three single-phase, 2,300/550-volt transformers. To this bank was added four new transformers designed to operate in parallel with those already installed. Three of these were used for a three-phase bank and the other as a spare. These were all grouped in one outdoor substation, as shown in the plan view. Both banks were fed from a single three-phase high-line bus and the spare was located at the end of the bus structure so that it could be connected in any of the six positions by shifting the high-side bus clamp.



WIRING SCHEME for transformer standby

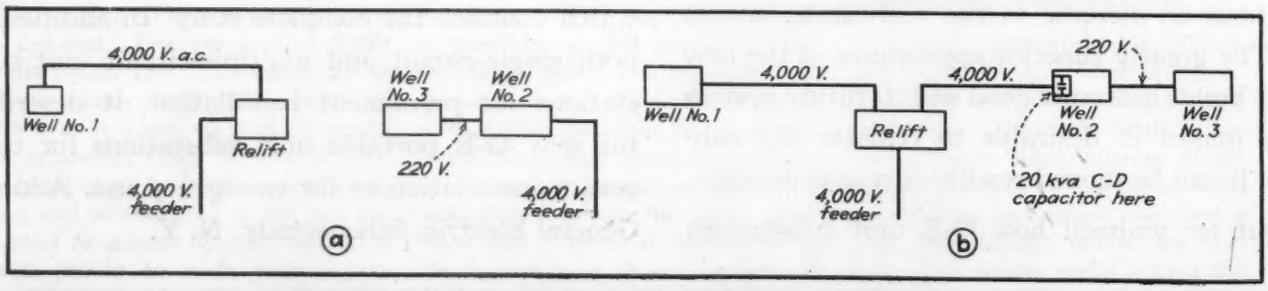
Another economy effected was the use of boric acid disconnecting type of fuses for each transformer, including the spare. Thus, if one transformer failed, the spare could be placed in operation as soon as the primary bus connection was made without the blown fuse link being replaced. This was possible since all ground connections were permanently made to the ground bus.

Light-load operation with 50 per cent capacity was obtained by using two three-pole, gang-operated disconnecting switches. Either bank can be used for light load or both banks for maximum load. The one-line diagram shows the switching scheme.

Improved Power Factor Earns 86 per Cent

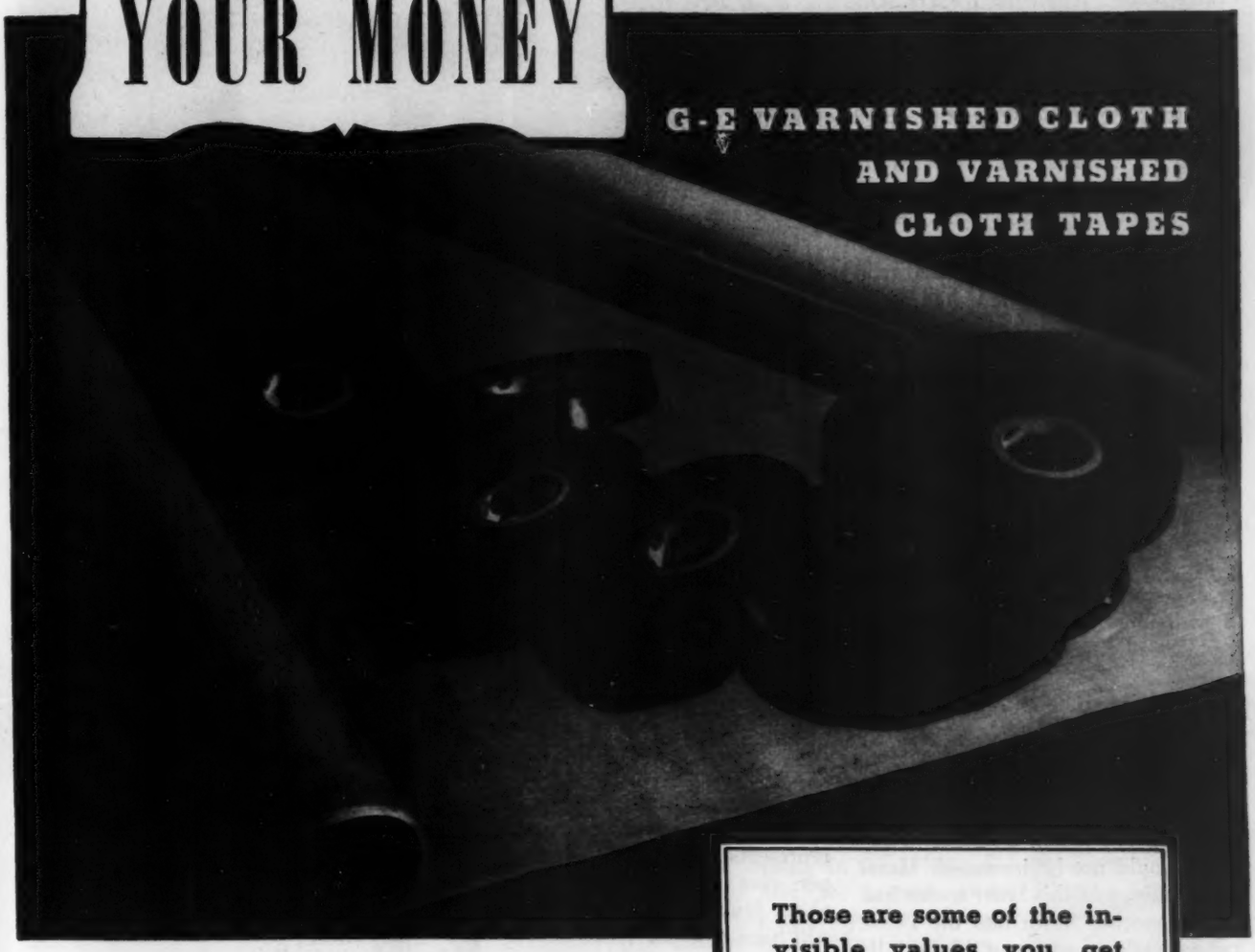
By W. L. KING
Chief Engineer Hemptsead Village Water Works, Hempstead, Long Island, N. Y.

Power factor improvement through the use of capacitors is not limited to the large consumer, but may prove valuable to the smaller consumer, as in the case of the Hempstead Village



SYSTEM of three wells and relift station before (a) and after (b) installation of capacitor

MORE FOR YOUR MONEY



HERE'S WHY:

CLOTH: Bought from best possible sources of supply. Chosen for strength, evenness of weave, freedom from specks. Must have minimum of nap, dressing and sizing so it can hold maximum amount of insulating varnish.

VARNISH: General Electric has over 30 years of experience in the manufacturing of insulating varnishes. We are constantly developing new varnishes. Only those best adapted for treating cloth are used for this purpose.

PROCESSING: Cloth makes 16 trips back and forth through a 90-foot oven—traveling more than 1/3 mile for each coating. Varnish continuously circulated and strained. Viscosity constant.

Those are some of the invisible values you get when you buy G-E varnished cloth and varnished cloth tapes.

The New General Electric Insulating Materials Catalog has an entire section devoted to varnished cloth — another entire section devoted to tapes. You should have a copy of this new catalog. If you do not, write to section M-0137, Appliance and Merchandise Department, General Electric Company, Bridgeport, Connecticut.

GENERAL ELECTRIC

Water Works. Here water is drawn from six wells, three driven from the power lines of the local power company, the other three Diesel powered.

Prior to last November power was drawn through two sets of 4,000-volt, three-phase, four-wire feeders. One entered the relift station with its four motors of 100, 150, 200 and 250 hp. and extended to well No. 1, which has 40-hp. equipment. The second feeder entered at well No. 2, where the step-down transformers were located for supplying both No. 2 and No. 3 wells with combined equipment totaling 125 hp.

The system comprising the relift station and well No. 1 had taken advantage of the 3 per cent discount, with a power factor of 85 per cent to 87 per cent maintained during the lighter load period of the six-month winter season. In summer, when the heavier load required the use of the larger equipment of the relift station, the power factor was increased to the 87–89 per cent range, earning 4 per cent.

The system of wells No. 2 and No. 3 with power factor of 80 per cent had not qualified for any discount.

Layout Simplified

By consolidating the relift station and three wells on one feeder the demand rate for the second feeder would be eliminated and that of the other would not be increased. Moreover, billings on this latter feeder had always reached down into the 1-cent range, while a good part of the billing for wells No. 2 and No. 3 had been at 3 cents. Under the consolidation the load added to the single feeder by these two wells would qualify for a straight 1-cent billing.

The over-all power factor of the combined systems would be such as to pull down the discounts formerly earned by relift and well No. 1 and this in turn would partially offset the savings resulting from the consolidation, so that it was decided to use capacitors to improve power factor.

As a result a single 20-kva. Cornell-Dubilier capacitor unit was installed, which would not only remedy the low power factor of wells Nos. 2 and 3 but qualify them for a 5 per cent discount. This unit was placed right at the primary side of the transformer bank which supplied the portion of the system having the poorest power factor—wells Nos. 2 and 3.

This saving includes (1) elimination of the previous separate demand rate for wells Nos. 2 and 3, (2) a straight 1-cent energy rate for energy consumed by wells Nos. 2 and 3 instead of the previous higher scale, and (3) the increased discount obtained through power-factor improvement.

The complete corrective capacitor unit, installed, cost $206. Its demonstrated earning of $14.74 per month represents an annual return of 86 per cent on this investment. In about fourteen months the capacitor will have paid for itself.

Fluorescent Light on Press Dies

To get good light on press dies All-Steel Equipment Company, Aurora, Ill., has placed a fluorescent tube inside each of the two columns of this press. The tubes are protected from damage by a wire screen, which, for easy lamp servicing or replacement, slides in and out of a sheet metal frame.

Eye Protection Glass for Welding

Furnace and foundry operations and the increasing use of arc welding present a complex problem in eye protection, since they involve safeguarding the eye not only from the glare of visible light but also from dangerous infra-red and ultra-violet rays. To aid in selecting the proper protection glass the American Optical Company has prepared the accompanying table; the suggestions are based on hundreds of proved applications, says the company.

Proper Eye Protection for High Temperature Operations

The Job	Glass	Density	Visible Light Transmission	Dangerous Ray Absorption	
				Ultra-Violet	Infra-Red
Carbon arc welding and cutting. Electric furnace operation	"Noviweld" 14*	5.57	0.0003%	100%	99.99%
Metallic electric arc welding 250 amp. or more	12	4.71	0.0019%	100%	99.99%
Metallic electric arc welding 75 to 250 amp	10	3.86	0.014%	100%	99.99%
Heavy acetylene cutting and welding	8	3.00	0.10%	100%	99.9%
Acetylene welding. Set-up work on electric welding. Fire box observations	6	2.14	0.72%	100%	99.9%
Acetylene burning, cutting and brazing	5	1.71	1.9%	100%	99.8%
	4	1.29	5.2%	100%	99.5%
Light brazing	3	0.86	14%	99%	98%
Bull ladlemen, spot, flash and seam welding	"Calobar" Extra Dark	0.70	20%	100%	95%
	Dark	0.46	35%	100%	92%
Employees in area of electric welding, stray or reflected light, low temperature fire box observations, rivet heaters, ladlemen, hand pourers	Medium	0.28	53%	100%	80%

* Numbers are from the Bureau of Standards density formulas.

Specify G-E Wiring Materials ...FOR DEPENDABLE ADEQUATE WIRING

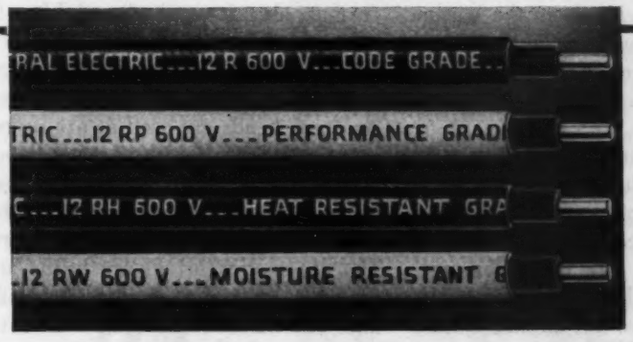
All members of the electrical industry agree that it is to everyone's advantage to have buildings wired adequately. Of course, true adequate wiring means more than the proper installation of heavy wires and sufficient circuits and outlets. It also means the use of dependable, quality materials that will give good service indefinitely.

G-E HIGH-QUALITY MATERIALS

General Electric wiring materials are ideal to use for an adequate wiring system. G-E conduit, wire and cable, and wiring devices are all uniformly high in quality. Only the finest raw materials are used. Manufacturing is done according to rigid specifications. And the line is complete, which means that exactly the right materials for any wiring job are available.

THREE G-E MANUALS FREE

Three manuals have been prepared by General Electric offering suggestions for adequate wiring in factories, on farms, and in homes, and showing appropriate wiring materials. To obtain any one, or all three, of these manuals or to obtain further information on G-E Wiring Materials see the nearest G-E Merchandise Distributor or check and mail the coupon below.


RAL ELECTRIC....12 R 600 V...CODE GRADE..
TRIC....12 RP 600 V...PERFORMANCE GRAD
C....12 RH 600 V...HEAT RESISTANT GRA
.12 RW 600 V...MOISTURE RESISTANT

General Electric Company
Section CDW-0137
Appliance and Merchandise Dept.
Bridgeport, Conn.

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GENERAL ELECTRIC

NEW ENGINEERING IDEAS

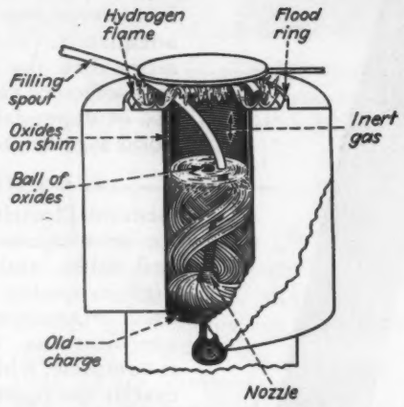
Process Improves Lead Cable Sheath

By C. A. PIERCY
Cable Engineering Department,
General Electric Company, Schenectady, N. Y.

Longer life and lower maintenance for lead-sheathed cable are expected to result from an improved lead sheath produced by a new process which eliminates laminations and imperfect die-welds. Key secret of the new process and the improved sheathing is a small charging nozzle which looks like an attachment for a meat grinder. This nozzle controls the distribution of the new molten charges of lead in such a way as to eliminate oxides, thus avoiding impurities and imperfections in the sheathing.

A three-compartment electric lead-melting pot with automatic recording and indicating devices to maintain accurate temperature control is used in the new sheathing process. In the first compartment the lead pigs are melted on shelf-type heaters elevated from the bottom so that oxides and dross can rise easily to the surface. Molten lead flowing from the bottom of the first compartment into the bottom of the second is kept under an atmosphere of inert gas to prevent oxidation.

CHARGING NOZZLE imparts controlled swirling motion to molten lead for cable sheath



NEW LEAD SHEATHING PROCESS keeps oxides out of cable covering

Molten lead enters press cylinder through filling spout—initially filled with inert gas—leaves charging nozzle with swirling motion that frees oxides from surface of old charge and pulls them to the center. Also pulled to center are oxides in lead shim left on cylinder wall from previous charging operation. Lighter than lead, the oxides rise naturally to the surface and are removed when new charge overflows into flood-ring at top of cylinder. Burning hydrogen blankets at top of cylinder prevent air from coming into contact with lead as ram is withdrawn from cylinder after extruding operation.

So that the introduction of cold lead pigs into the first compartment will not affect temperature of the lead in the third compartment, which feeds the press, the third compartment is thermally isolated from the two others; it also has an atmosphere of inert gas. The molten lead is started on its way from the third compartment to the press cylinder under pressure through a pipe initially filled with inert gas. In the charging operation (illustrated), the nozzle is placed close to the surface of the previous charge of solidified lead. The die block used in the new process has specially designed flow passages, so that the oxide-free lead is applied to the cable with greater uniformity of thickness.

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Composite Metal Is Welding Outgrowth

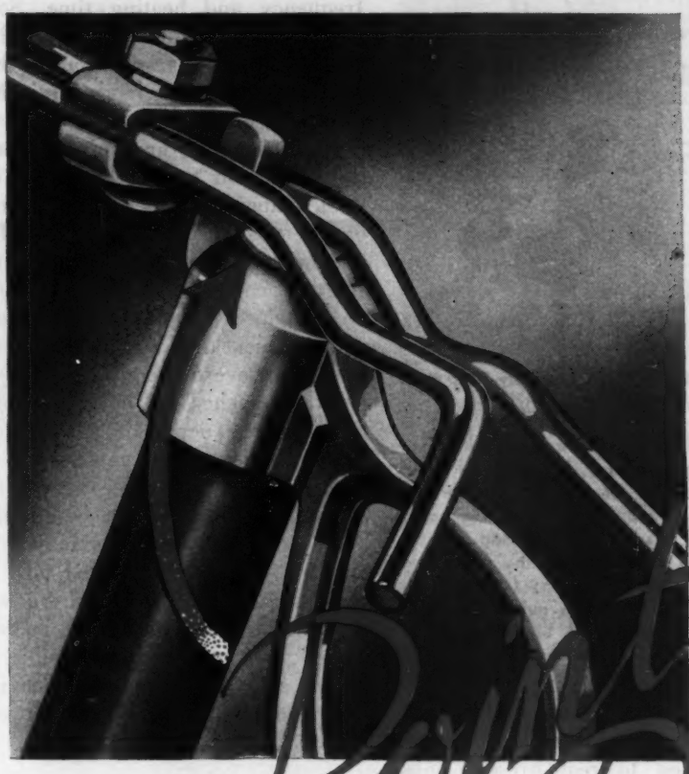
By ROBT. E. KINKEAD
Consulting Engineer, Cleveland, Ohio

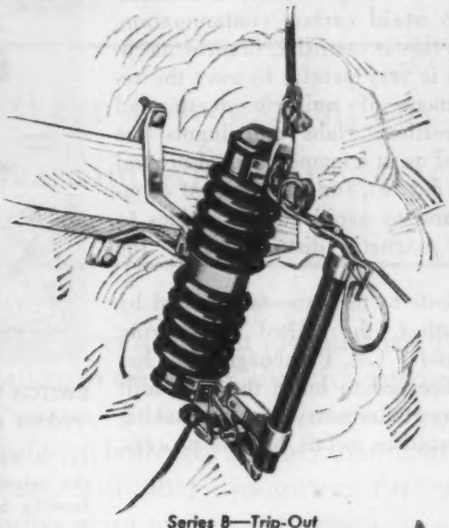
Electrical features of the "Surface Alloying Process," by which the surface of a slab or ingot of low-carbon steel may be alloyed to stainless steel or high-carbon steel or other composite metal of predetermined physical properties, are an interesting outgrowth of electric arc welding practice.

The alloying element to be added to the original low-carbon steel is applied uniformly to the surface; ferrochromium is used where the surface is to be made over into the commonly used 17 per cent chromium alloy. A furnace slag is applied and Lincoln "Tornado" carbon arc heads are used to melt both the surface being treated and the alloying element being added. As many heads are used as are necessary to cover the width of metal being alloyed. Depending on the thickness of the composite metal to be made, the arcs may be from 3 to 18 in. apart. The automatic carbon arc heads are mounted on a carriage which oscillates sidewise and moves forward to cover the whole surface with a very uniform distribution of heat. This is essential to provide a uniform depth and composition of alloy.

The individual arcs may carry anything up to 3,000 amp. with an arc

FROM THE ENGINEERING DEPT.—JAMES R. KEARNEY CORPORATION





Series B—Trip-Out
5000 to 15000, 100 Amp.

Point Pressure CONTACTS

OPERATING men will tell you that, regardless of how well a fuse switch might be built, in other respects—it's how long contacts will retain their rated capacity that counts when it comes to dependable, trouble-free switch performance.

So in designing contacts for the Kearney Trip Out Switch, true point pressure contacts were adopted because: point pressure contacts establish a clean, wiped-in pressure surface when in operating position; they are adaptable in establishing direct pressure on the fuse link button head; resilient contact member permits expulsion shock to be harmlessly absorbed —also, permits button head to operate on a poppet valve principle to relieve excessive gas pressures from the top as well as from the bottom of the cartridge.

Yes, we consider point pressure contacts a most important factor in the long, satisfactory performance of the thousands of Kearney Trip Outs in service today and we should be glad to discuss other features . . . How costly cartridge burnouts have been overcome—how this switch gives positive operation on low overloads, as well as on heavy short circuits, and other advantages. A Kearney Representative can give you some profitable information about Kearney Trip Outs, we feel sure. Or, write and we shall be glad to give you the specific details and data.

JAMES R. KEARNEY CORPORATION
4236 Clayton Ave., St. Louis, Mo.
Canadian Plant - Toronto, Canada.

USE KEARNEY PRODUCTS

FOR BETTER MAINTENANCE and CONSTRUCTION

voltage around 50 volts. Direct current is used in preference to alternating to avoid carbon contamination, where this is essential. Control mechanism is very precise to meet the requirement of uniform depth and composition. Slabs and ingots are worked on at a temperature of around 1,500 deg. F., for electric heat economy and to avoid current values to cause magnetic disturbance to the arc.

Patents to the process are held by the author; the United Engineering & Foundry Co., Pittsburgh, Pa., has been licensed to build the steel mill equipment necessary for the making of composite metals by this process.

•

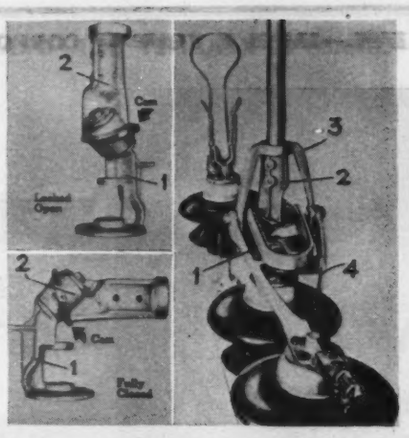
Switch Design Eliminates Braids

By H. W. YOUNG
President Delta-Star Electric Company, Chicago

In this new switch design high-pressure, full-floating, self-aligning contacts are provided at both ends of the blade without the use of flexible braids or shunts. In brief, the blade mechanism converts the rotating motion of the operating insulator to the vertical swinging movement of the blade and also turns the blade to make the contact.

The switch mechanism has four main working parts, mechanically arranged to permit a predetermined and positive movement through a chain of four bearings, as follows: A bearing between switch frame and the 45-deg. driving crank permits the insulator to rotate; a bearing between the 45-deg. crank and the blade pivot provides a modified universal action; a bearing between the blade pivot and blade guide permits the blade to turn, but maintains the vertical blade path; a hinge bearing between blade guide and switch frame permits raising and lowering of switch blade. As the 45-deg. driving crank is turned by the rotating insulator the blade turns and lifts to the full 90-deg. position.

The switch blade automatically locks in both the open and closed positions and the blade turns within the stationary contact before it is raised vertically, thus releasing or applying high-contact pressure with small driving effort. At the hinge end of the blade a cam on the 45-deg. crank engages the U-shaped spring-reinforced fixed contact as the blade swings open or closed. This cam is "high-spotted" to create pressure only at the closed end of the main blade. This pressure is applied gradually and uniformly to eliminate sudden applications which might cause jerking or uneven blade operation.



SWITCH MECHANISM has only four main working parts

(1) A 45-deg. inclosed crank attached to the rotating insulator; (2) a blade pivot forming both the bearing housing for the 45-deg. crank and part of the hinge contact; (3) a blade guide insuring vertical travel of the blade, but at the same time allowing the blade to turn; (4) a switch frame to which the blade guide is hinged. The 45-deg. bearing with blade fully open and fully closed is shown at left.

There are no stops to limit the swing of the blade as it approaches closed position, just before its final turning to make a high-pressure contact. This arrangement insures smooth operation and absence of shocks or jars.

•

Induction Heating Progresses

Induction heating as a rapidly advancing means of surface hardening of steel parts of modern machinery received extended comment in the "Industrial Bulletin" issued by Arthur D. Little, Inc., Cambridge chemical engineers, recently. The method has gained much headway in three years. Originally intended for hardening the bearing surfaces of heavy-duty crank shafts, it now has been extended to lighter parts, such as camshafts, gears, tools and even ice skates. It is simpler than the cumbersome case-hardening process, the process is automatic once the controls have been set and eliminates variability due to the operator. The depth of hardness may be predetermined accurately by regulation of current, frequency and heating time. Scale formation is avoided and a fine-grained structure results, harder than could be obtained from equivalent furnace heating.

High-frequency hardening starts at the surface of the work, but as the steel temperature rises it loses much of its responsiveness to high-frequency current and the effect of the current penetrates further down into the metal. By control of frequency and treatment time it is possible accurately to govern the maximum temperature reached by the treated part and also the depth of heating. In practice, the current is induced by a coil-containing ring which fits around, but does not touch, the part to be treated. Water jets built into the ring quench the treated part as soon as the heating is ended. So well may the incidence of heating be controlled that it is easily possible to harden a localized area while leaving the remainder of the piece soft and ductile.

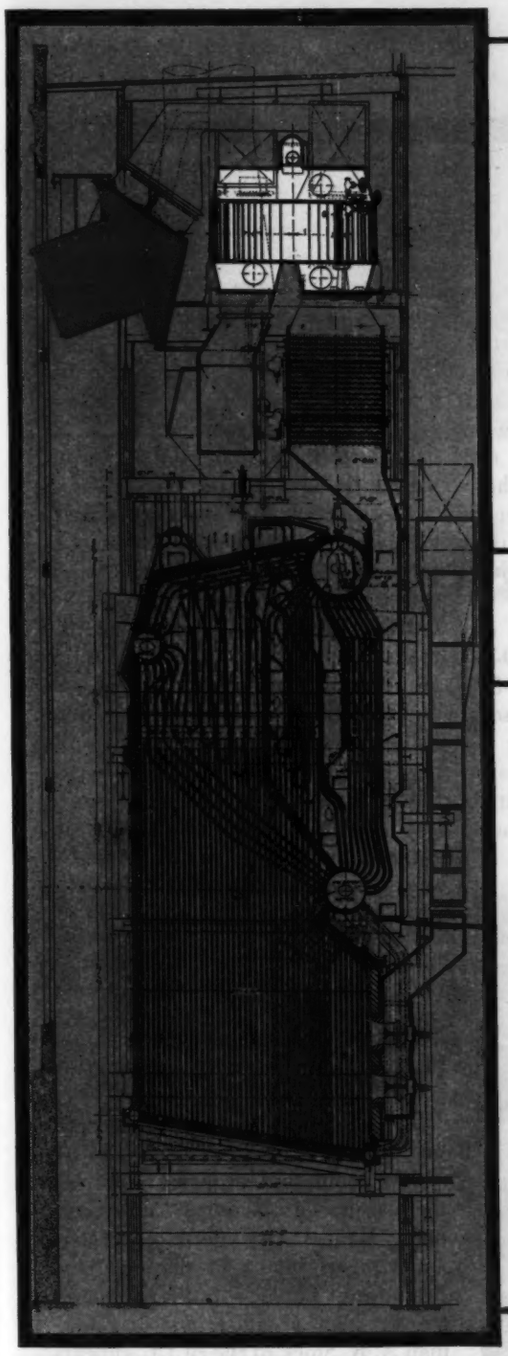
Speed is Chief Feature

Outstanding among the advantages of the process is its speed. Whereas the furnace treatment of large pieces often requires hours, the heating and quenching cycle induction hardening requires a matter of seconds or less, and in one hour, with two hardening machines and one operator, 30 large truck crankshafts may be treated. With smaller parts, the production rate may run up to 6,000 pieces per hour with one machine. The compactness of the equipment and the high output rate often permit treating to be inserted into the production line, thus eliminating transportation to a separate building.

In a representative application, not covered in the Little bulletin, various sizes of chuck bodies are hardened by a 250,000-cycle current to 1,450 deg. F. Heating and quenching are automatically controlled within plus or minus 0.05 seconds. To handle various sizes of chuck bodies it is only necessary to change the inductor coil, which can be done in five minutes. A converter run off the shop power distribution circuits provides the high-frequency current, and the heat is confined to the area to be hardened and not, as of old, to the entire front end of the chuck body.

Still on Top Tho' Boilers Differ

New Steam Unit of An Important Southern Power Company Continues its Consistent Use of Ljungstrom Air Preheaters



In this new steam generating unit just purchased by a well-known utility in the South, the Ljungstrom Air Preheater is again "on top." It will serve alongside 3 other Ljungstroms installed with boilers of another manufacturer more than 12 years ago. Still other Ljungstrom Preheaters are in service at another plant of the same system.

Oil-fired, the new unit (left) will operate at 300,000 lb. steam per hr., 908° F. total temperature, and is designed for a maximum pressure of 1,025 lb. Gas enters the Ljungstrom Preheater at 615° F., leaves at 301° F., preheating the combustion air to 507° F.

The Modern Ljungstrom Air Preheater

To the recognized thermal superiority of the *continuous regenerative counterflow* principle, the *modern* Ljungstrom Air Preheater now adds an extra measure of mechanical surety. The resulting clear margin of advantage for the Ljungstrom in any economic balance calling for high levels of heat recovery is indicated by today's installation records: *Today more Ljungstroms are being installed in power plants than all other types of air preheaters combined.*

Engineering evidence which confirms this margin of advantage — evidence which shows how constructional improvements have stepped up present-day performance — is available on request. It will be of noteworthy economic interest to engineers and other executives concerned with power-plant design or responsible for operating efficiency and availability. May we send you a copy?

THE AIR PREHEATER CORPORATION

60 East 42nd Street **New York, N. Y.**

LOAD BUILDING

Unit Air Conditioning Solves Store Problem

Utilities involved in air-conditioning plans for department store prospects usually face the three problems of (1) loss of business during the installation period; (2) the difficulty of a step-by-step program; (3) the necessity for redecoration of the store to fit into the new air-conditioning equipment.

In a similar case which arose in the Globe store at Scranton, Pa., unit air conditioners have proved to be the answer. Although the original plans called for conditioning only the second floor, the new system has been so satisfactory that the department store has mapped out a program for installation of air conditioning on the first floor and for ultimate air conditioning of the entire five-story building.

The program began with the second floor because recent modernization changes have restricted ventilation seriously. A survey of the floor immediately showed that a central plant installation would not be practical. Floor space was inadequate and expense would be prohibitive. Further, each department to be conditioned was isolated from the other, which would greatly complicate any duct system from a central plant.

The arrangement decided upon includes six General Electric FD-70 unit air conditioners and one FD-50. Duct work is not visible from the selling area—only the grilles being in sight. Only small portions of easily spared stockroom space are required for the equipment. Normal business was not interrupted during installation. Practically no redecoration was necessary and the period required for installation was comparatively brief. Also important, the unit conditioner system permits the department store manager to juggle his sales section to meet varying demands, because both the unit and the duct work are easily moved.

Since seven units are in use there are seven points of thermostatic control. As a result areas can be conditioned independently as cooling is required, providing diversity in the loads. Four of the conditioners utilize an adjustable outside air supply and at night the fans alone are used to bring in cool night air. This results in lower fan cooling costs and longer hours of use of service. In the morning, when the regular cooling is begun, the compressors rarely start for two hours because of this nighttime operation.

METHOD OF INSTALLING unit air conditioner in stock space behind selling area on second floor of store in Scranton, Pa. Unit air conditioners used because store layout made central plant system impracticable. Installation consists of six General Electric type FD-70 and one type FD-50

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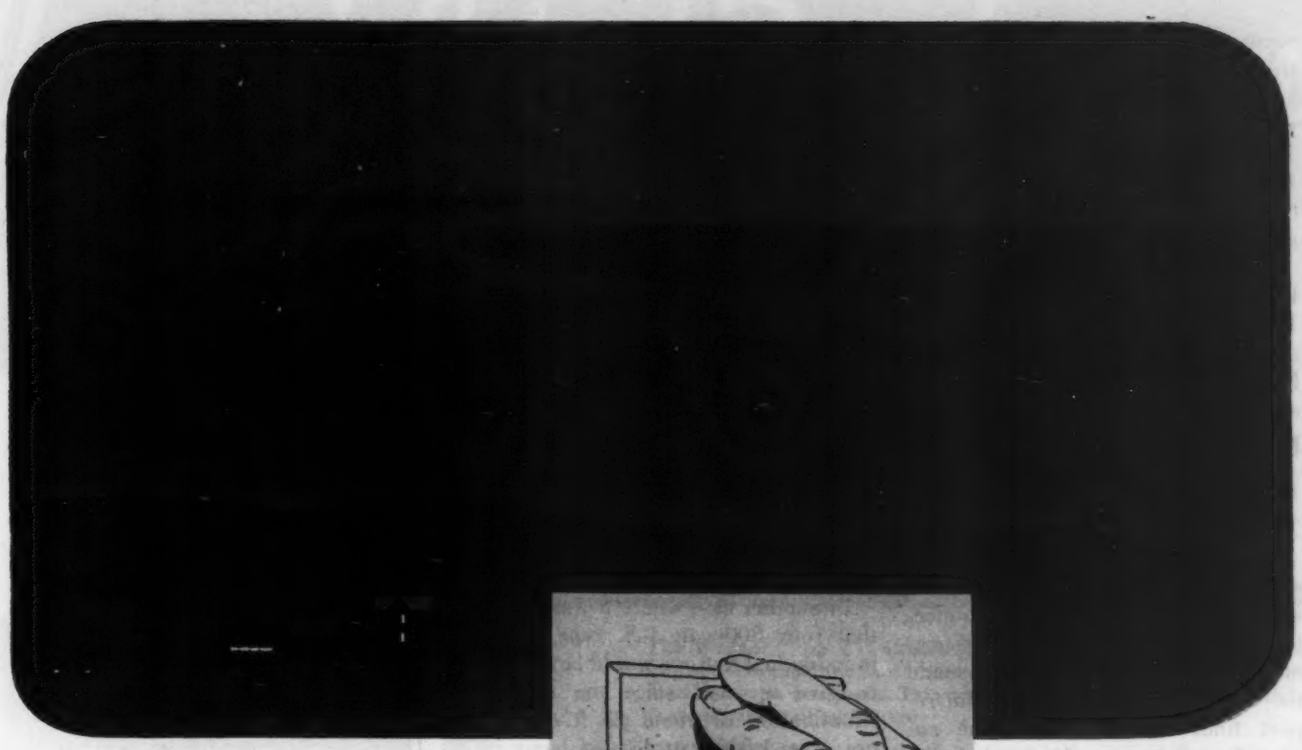
Stoker Promotion Program Succeeds

A year has passed since the start of the now famous co-operative stoker promotion program featuring the Kansas City Power & Light Company, Kansas City electrical dealers and the originator of the idea, the Bituminous Coal Utilization Committee. In the year-end report of Chairman A. R. Stock of the BCUC appears unmistakable evidence of the success of the program and of the important part played by the Kansas City utility.

The Stock report shows that prior to February, 1939, 3,364 stokers were in operation in Greater Kansas City and within the radius of 200 miles



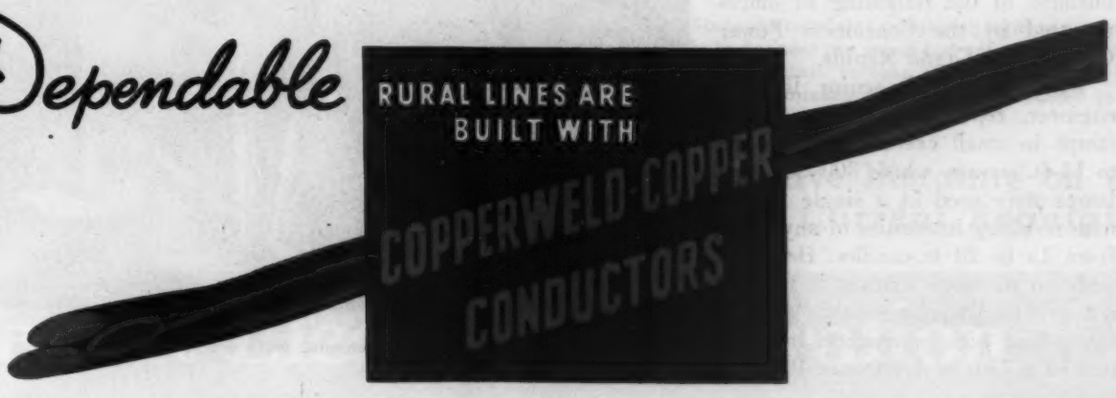
Dependable RURAL LINE SERVICE BUILDS LOAD INCREASES REVENUE

WHEN the farmer learns that the snap of a switch can be depended on for low-cost light and power he will find many and varied uses for electricity. Milking machines, water pumps, portable motors, yard lighting, washing machines, milk coolers, and refrigerators will consume more and more kilowatt hours. The farm load will increase as the farmer realizes he can depend on his rural lines. Dependable rural line service demands conductors that will stay up and deliver power every day—in all kinds of weather.

The Copperweld strength wire used in Copperweld-Copper Conductors has all the enduring life of the solid copper conductor wires — a completely non-rusting combination. The stranded triangular 3-wire (unsymmetrical) shape of Copperweld-Copper Conductors reduces vibration by *inherent* soundness of design. That's why Copperweld-Copper Conductors have little or no tendency to vibrate even when strung on long spans with high stringing tensions.

Rural line revenues will increase when the service is dependable—and rural line service is more dependable when vibration-reducing, non-rusting Copperweld-Copper Conductors are used.

COPPERWELD STEEL COMPANY, GLASSPORT, PA.



covered by local newspaper circulation. These 3,364 stokers had been added over a period of years. Since the campaign started in February, 1939, and up until the beginning of 1940, 1,523 stokers were added in this same area, or nearly one-third of all stokers now operating.

Of the 778 stokers sold in Greater Kansas City alone since February, 1939, 670 were domestic units, and of these the Kansas City Power & Light Company handled 143. Analysis of the first 100 stoker sales by the power company shows:

14—were installed in new homes.
26—replaced gas or oil.
56—replaced smokeless coal.
4—replaced soft coal, or miscellaneous.
100

In addition, the committee report states that the company sold 26 electric ranges, water heaters or refrigerators at the same time that it made the above sales. In this fact the report finds indication that the co-operative effort proved not only beneficial to coal and stoker industries but to the electric appliance industry as well.

Plans for continuation of the stoker campaign during the coming year call for:

1. Promotional advertising in Kansas City papers similar to that used last year.
2. Aid to new home builders through a subsidy to introduce a complete coal-burning equipment to this field.
3. Support to the stoker industry in setting up an exhibit at the Better Homes Show, comparable to 1939.
4. Co-operation with the Kansas City Power & Light Company in setting up an all-electric exhibition home with modern automatic heating plant installed.

•

Compact Bi-Post Lamps Aid Office Relighting

Compactness of 750- and 1,000-watt bi-post lamps compared to PS type incandescent lamps of the same rating has contributed to a brisk business in the relighting of offices reported by the Consumers Power Company in Grand Rapids.

W. A. Stannard, senior lighting engineer, reports widest use of the lamps in small executive offices, 12 to 14 ft. square, where 300–500-watt lamps were used in a single fixture with resulting intensities of anywhere from 15 to 20 ft.-candles. Here the addition of more fixtures is usually not provided for or would "crowd" the ceiling with luminaires. Installation of a 750- or 1,000-watt PS type lamp would require a fixture larger than the usual 18–19-in. unit and involve considerable expense. However, the customer is frequently ready and willing to accept the wattage increase when he finds that by the use of a bi-post lamp he can secure a considerable boost in illumination and use his existing small fixture.

For example: In one office in Grand Rapids two semi-indirect units equipped with 500-watt, silvered-bowl lamps were giving 20–25 ft.-candles. The customer wanted more light. It was found that by removing the silver-bowl lamps, inserting a silvered cup in the fixture and installing two 750-watt bi-post lamps the illumination could be increased to an average of 30–35 ft.-candles.

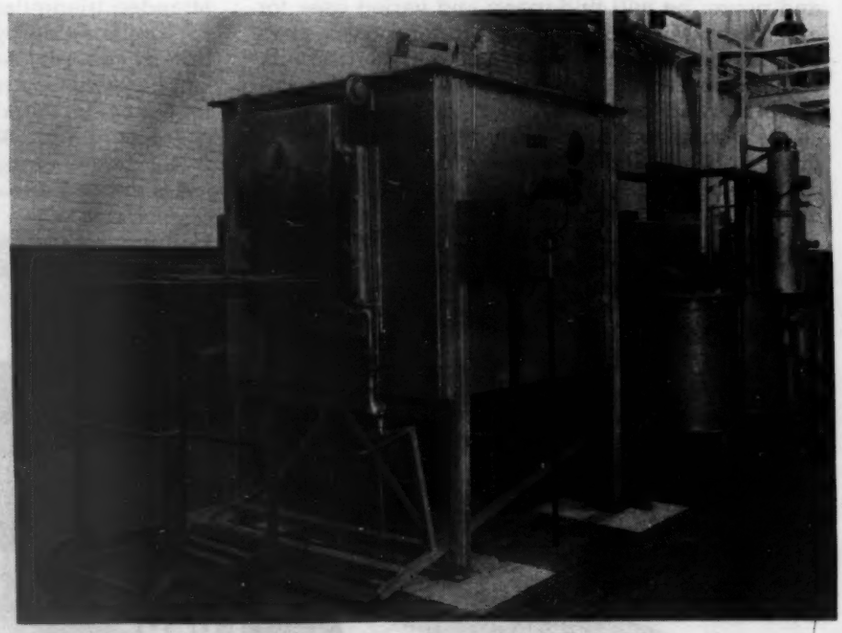
In another case where it was found that four 300-watt P.S. type lamps in individual fixtures would be needed to give a small office the desired illumination of about 25 ft.-candles use of a 1,000-watt bi-post lamp in the existing single 18–19-in. fixture gave an entirely satisfactory illumination level of between 23 and 27 ft.-candles.

Within the past twelve months about 25 installations of bi-post lamps have been made in relighting business offices in and around Grand Rapids, a large portion of which would not have been sold had it not been for the compactness of this lamp compared to the conventional incandescent P.S. type lamp.

Multi-Purpose Furnace Serves Engine Plant

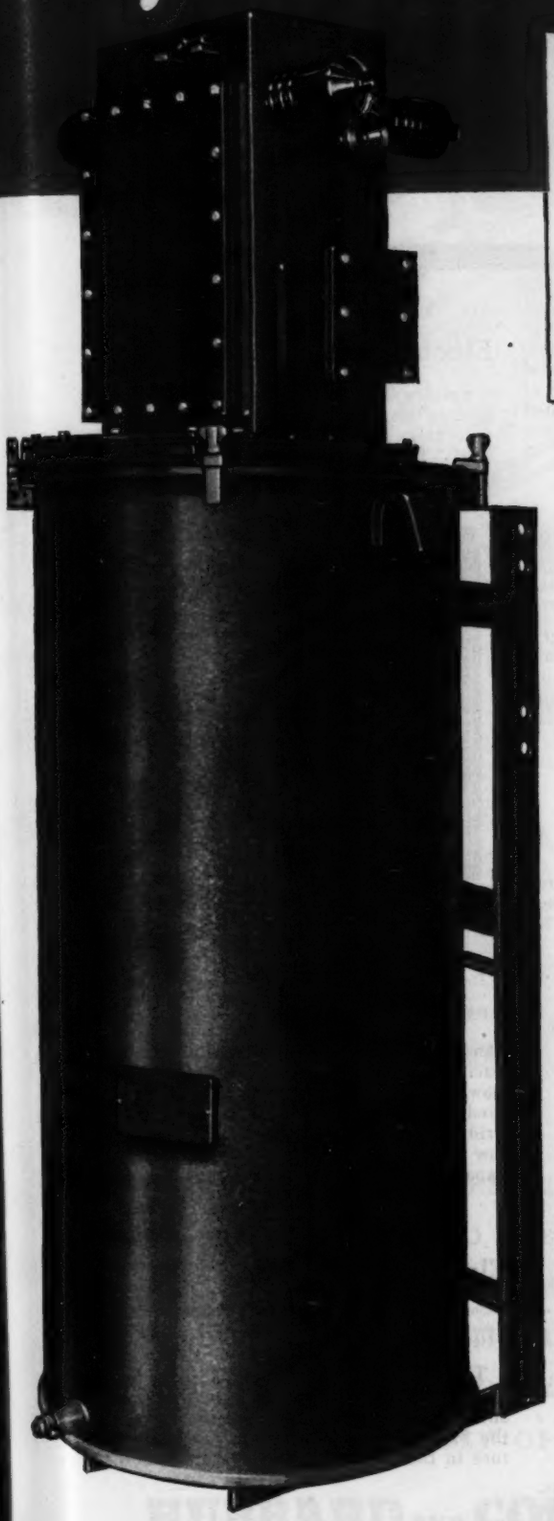
In the engine-making section of a factory producing airplanes a 50-kw. electric brazing furnace was installed with noteworthy benefits in view of the demand for more accurate production and diversified application. The electric brazing largely superseded hand soldering with silver, formerly done outside the factory, and saved time in handling material for this reason. The equipment has a fully controlled atmosphere, including the cooling chamber, to prevent scaling. In the furnace copper in the form of wire or paste is applied to tight joints with temperatures in the vicinity of 2,000 deg. F., to form strong permanent bonds. The process often eliminates expensive machining and improves the quality of the product materially.

The furnace can readily be used for hardening and is equipped with a trap-door through which hardened parts may be dropped into a quench tank beneath without being withdrawn from the controlled atmosphere. The product is cleaner and more uniform and without the localized hardening sometimes found in torch heating, and production is ten times as fast as with the former hand methods. Energy to the furnace is supplied from a 220-volt, three-phase shop circuit.



BRAZING, HARDENING and experimental work are handled in a single electric furnace in one plant

Wagner's Latest Development



Wagner Type Y-H Constant Current Regulator

For Series Street Lighting Systems, Boundary and Signal Lighting for Airports, Flasher Signs for Advertising, and similar applications requiring constant current at all loads.

The Wagner Type Y-H Constant Current Regulator furnishes constant current to the lamp circuit from zero load (short-circuited loop) up to full load and even overloads. This new type regulator has many outstanding features, some of which are:

1. UNIT ASSEMBLY—Unit makes a neat and compact assembly. Can be used for pole, platform, or vault installations without reassembly of any parts.
2. NO MOVING COILS—Instant adjustment to changes in load.
3. HIGH EFFICIENCY—From fractional to full-load the efficiency is very high.
4. UNITY OR LEADING POWER FACTOR—When the loop load is non-inductive the power-factor of the current feeding the regulator is unity. On the other hand, if the loop contains inductive apparatus, the power-factor in the supply line is leading.
5. LOW SUPPLY CURRENT—Under normal operating conditions, the current drawn from the line is extremely low due to the high power-factor and high efficiency of this unit.
6. GOOD VOLTAGE REGULATION—Due to the low supply current drawn from the supply line, the drop in voltage from the power house to the regulator is very small. This is of extreme importance to the small isolated power plants that supply energy to series street lighting systems. The use of the Wagner Type Y-H regulator improves the generator voltage regulation and increases the KW capacity of the generator for useful loads.
7. PROTECTED AGAINST FAULTS IN LOOP CIRCUIT—If a break occurs in the loop circuit, the unit quickly disconnects itself from the supply line. If a short-circuit occurs in the loop circuit, the output current maintains its normal value but the input current drops to a negligible value. Under this condition, the regulator can operate indefinitely without overheating.
8. NON-SPARKING SWITCHING EQUIPMENT—Switch contacts never open or close under load, resulting in practically sparkless operation, long life, and minimum maintenance.
9. EASILY INSTALLED—Since the regulator and switch form a unit assembly it is necessary merely to connect the input and output leads to their corresponding terminals on the unit. In case of remote control, low-voltage control wires must be connected to terminals located in the control-wire conduit box.

Write today for descriptive literature on the Wagner Y-H Constant Current Regulator

Wagner Electric Corporation

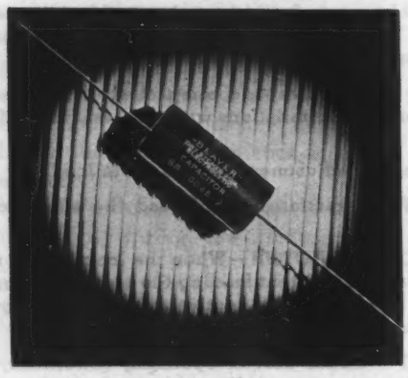
6400 Plymouth Avenue, Saint Louis, Mo., U.S.A.

TRANSFORMERS • MOTORS • FANS • BRAKES

NEW EQUIPMENT

A. C. Capacitor

Etched-foil, dry electrolytic type capacitors in various capacities up to 50 mfd. The largest size is 1x2⅛ in. Each unit is contained in a hermetically sealed aluminum tube which is jacketed in a varnished cardboard tube. They are especially designed for starting service with low-voltage, "flea" power motors used in the auxiliary control equipment of oil burners, air-conditioning equipment, etc.



A.C. capacitors for flea power motors; rated at 25 volts. **Cornell-Dubilier Electric Corp.**, South Plainfield, N. J.

•

Float Switch

A new float switch designed specifically for domestic sump-pump control. **General Electric Co.**, Schenectady, N. Y.

Switch is single pole, employing an overcenter toggle mechanism. Float rod weight is counterbalanced by a calibrated spring acting on the operating lever. The control is built for mounting in the motor end shield or some suitable part of the pump.

•

Single-Phase Motor

Vertical single phase motors in sizes from ¾ to 5 hp. **Fairbanks-Morse & Co.**, 600 S. Michigan Ave., Chicago, Ill.

Operating speeds of this line of motors are 1,200, 1,800 and 3,600 r.p.m. All 1,800-r.p.m. and lower speed motors are built in the repulsion start induction-run type. The solid shaft units may be direct-connected to a pump or machine through a flexible coupling. The hollow shaft unit is particularly well adapted, states the company, to vertical pump applications. Because of its combination of electrical and mechanical characteristics this line of motors is adaptable to operate in isolated localities where small pumping units are located.

•

Fuse Block

A new fuse block for the type PT indoor potential transformers. **Westinghouse Electric & Mfg. Co.**, East Pittsburgh, Pa.

The block contains a fuse mounted in a hinged molded bakelite cover and is available in ratings from 230 up to 2,300 volts. This protecting device has solderless connections. All live parts are inclosed in the walls of cover and base.

•

Spot Welder

This company announces the standardization of its line of spot welding machines. Each of the three frame sizes is said to be able to house either of two transformers. Interchangeable parts are used to meet the different ranges of applications.

A line of standardized spot welding machines. **American Electric Fusion Corp.**, 2610-2622 Diversey Ave., Chicago.

For names, addresses and products of electrical manufacturers, see "Electrical World" *Electrical Buyers Reference* first.

Electronic Bridge

Besides being used as a conventional bridge this instrument can be used as a percentage bridge and also as a synchrometer. The circuit features a cosine galvanometer. Its measurements include capacity, resistance, inductance, impedance, power factor and frequency. It is operated by a.c. power. It is said that the bridge can detect change in capacity as low as 1 micromicrofarad and measures capacity beyond 1,000 microfarads.

Electronic bridge, Model 575, featuring electrical triangulation. **Hickok Electrical Instrument Co.**, Cleveland, Ohio.

•

Electric Fly Screen

Electric fly screen with current consumption of 4 watts. **Detjen Corp.**, 303 West 42d St., New York City.

The fly screens are installed in a few doors and windows of a barn or dairy, or such buildings. As the flies pass between the bars, spaced 9/32 in. apart, the moisture in their bodies causes a short circuit.

•

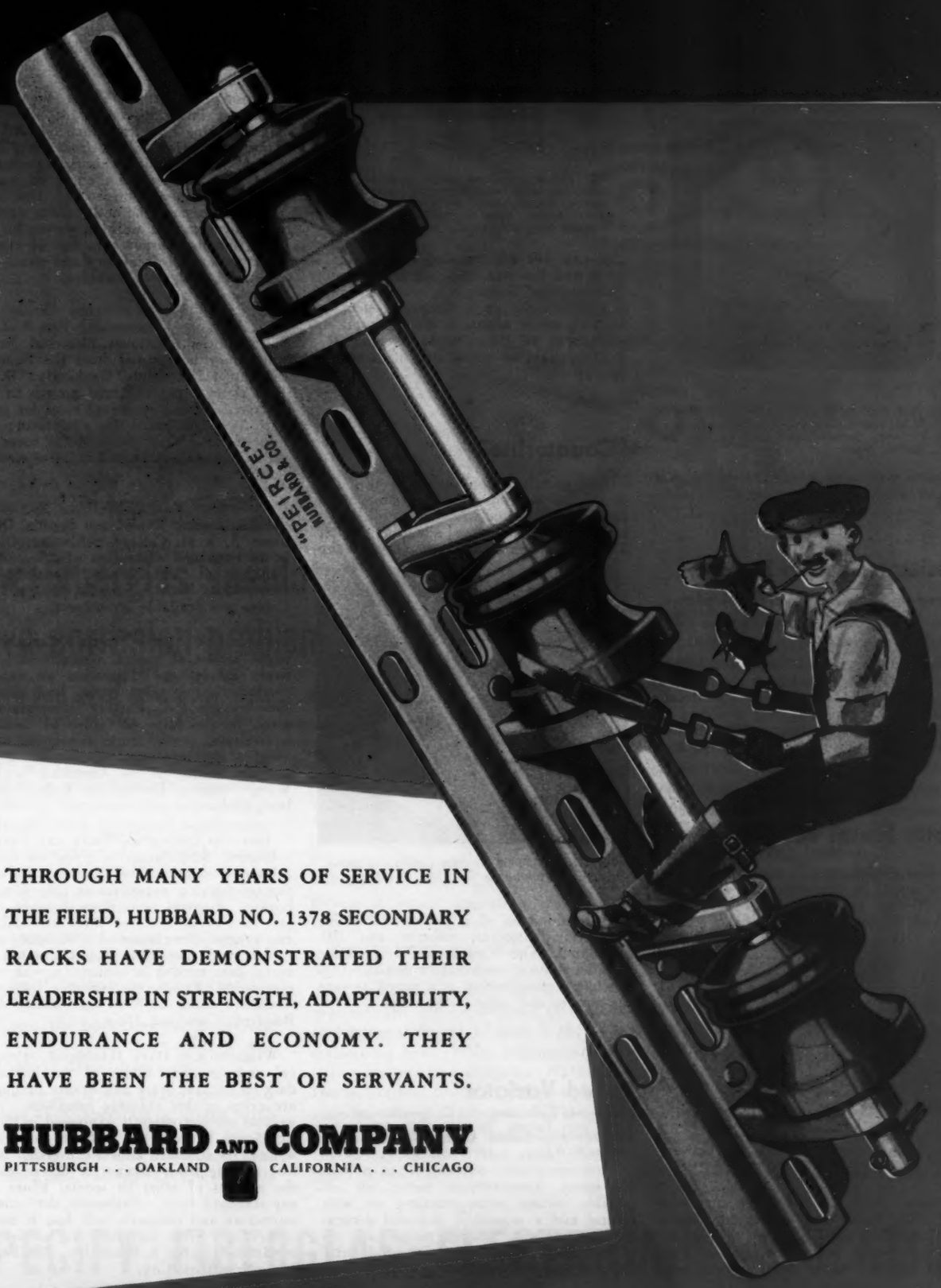
Motor Control

Sectional motor control center. **Trumbull Electric Mfg. Co.**, Plainville, Conn.

Each section is 91 in. high and accommodates five size 1 (1½-7½ hp.), three size 2 (7½-25 hp.) or two size 3 (10-50 hp.)

"TO BE A GOOD LEADER-

ONE MUST FIRST HAVE BEEN A GOOD SERVANT"



THROUGH MANY YEARS OF SERVICE IN THE FIELD, HUBBARD NO. 1378 SECONDARY RACKS HAVE DEMONSTRATED THEIR LEADERSHIP IN STRENGTH, ADAPTABILITY, ENDURANCE AND ECONOMY. THEY HAVE BEEN THE BEST OF SERVANTS.

HUBBARD AND COMPANY

PITTSBURGH . . . OAKLAND CALIFORNIA . . . CHICAGO

"HANG THE LOAD ON HUBBARD HARDWARE"

motor starter combinations. Either entire units or internal operating mechanism removable from front. Each section contains vertical busbars with solderless lugs available either top or bottom for load connections. Individual sections may be combined in any desired number to complete switchboard installation.

•

D. C. Meter

This instrument is said to fit a large number of small to medium large rectangular panels. Equipped with D'Arsonval

Type 607 d.c. meter in a molded case 3⅛ x 3 5/16 in., round back 2¼ in. diameter; scale 2¼ in. long. **Burton-Rogers Co.**, 857 Boylston St., Boston, Mass.

jeweled movement and supplied as voltmeter, ammeter, milliammeter or microammeter.

•

Resistor Decade Box

Power resistor decade box for laboratory use, for calibration of meters and development work. **Clarostat Mfg. Co.**, Brooklyn, N. Y.

This box covers a resistance range of from 1 to 999,999 ohms at a maximum of 1,000 volts, by means of six decade switches. Each decade will dissipate up to 225 watts. The instrument measures 13 in. long by 8¾ in. deep by 5¾ in. high and weighs 11 lb.

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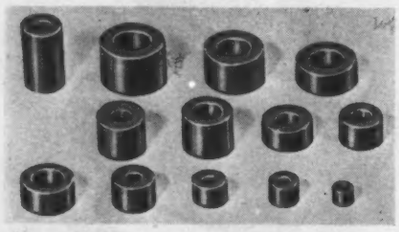
Motor Shunt Beads

A new glazed ceramic motor shunt bead is announced by this company. It is made of AlSiMag and is said to have high mechanical strength, density and electrical

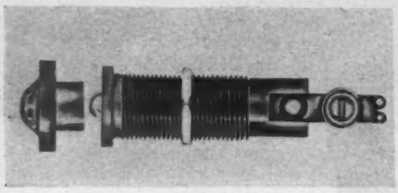


New glazed ceramic motor shunt bead in a wide range of sizes; developed to take the place of imported glass beads. **American Lava Corp.**, Chattanooga, Tenn.

resistance, even at elevated temperatures. The inside area is lubricated by a glazed coating, said to lower friction, facilitate stringing and safeguard the wire against tearing during assembly and use.

Indicating Lamp

A feature of this new unit is the "anti-false" color characteristic—the plastic shell and lens-cap are molded in the same color. Two spring-tempered contact-terminal strips serve to contact the lamp bulb and to provide the incoming wire terminal connection. On all standard low voltages up to 48 the T2 unit is used without a resistor assembly. For service on 120,



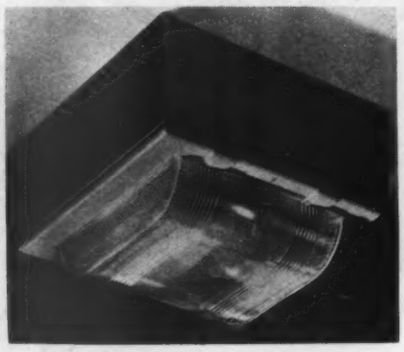
"T2" unit is a molded plastic unit for use in indicating lamp service, panelboards, switchboards, annunciators, etc.; colors are red, green, amber, blue and milky white. **H. R. Kirkland Co.**, Morristown, N. J.

220 and 440 volts a standard resistor is used with the unit. On 120 and 220 volts a "Dim-brite" feature is accomplished with a split resistor on a three-wire electrical circuit, which allows a dull glow to be evident at all times, and switching to a brilliant light on actual indicating service.

•

"Counterlite"

The principal application of this unit is for the lighting of store counters. It projects an asymmetric beam of light—narrow across and spread along the counter. This effect was accomplished by the op-



"Counterlite" E-814, for the lighting of store counters. **Holophane Co., Inc.**, 342 Madison Ave., New York, N. Y.

tical combination of a double Holophane prismatic Controlens, reflector and 300-watt lamp. The "Counterlite" is available for recessed or exposed mounting. Its secondary distribution is directed toward the shelves and store traffic areas.

•

Speed Variator

Complete speed-variator equipment operating from 3-phase, 60-cycle, 200-, 440- and 550-volt a.c. **General Electric Co.**, Schenectady, N. Y.

Each equipment consists of an adjustable-speed, direct-current motor, an adjustable voltage motor-generator set with control and a separately mounted generator-field rheostat. Speed ranges are up to 16:1 ratio. Applicable to the industrial field for material-handling operations.

TECHNICAL LITERATURE

COMBUSTION CONTROL—Basic problems in efficient boiler operation and details of the methods of automatic combustion control are discussed in a new 94-page data book, No. S-21, published by Republic Flow Meters Co., 2228 Diversey Parkway, Chicago, Ill. This book, a text on modern combustion control methods, includes a number of installation reports on specific installation, illustrated with diagrams and presenting performance data for all sizes of boilers, all types fuel-firing, all load conditions.

WOOD INSULATION—"What Wood May Add to Primary Insulation for Withstanding Lightning," preprint from 1940 A.I.E.E. *Transactions*, is available from Ohio Brass Co., Mansfield, Ohio. This eight-page publication points out the effect of length, moisture content, creosoting treatment, cross-section and kind on lightning strength of wood; contains working curves for figuring impulse flashover voltage of various combinations of insulators and wood and illustrates with five examples.

ELECTRIC FENCES—"Safety Rules for Electric Fences," comprising Part 6 of the Fifth Edition, National Electrical Safety Code, may be secured from the Superintendent of Documents, Washington, D. C., at 5 cents a copy. Rapid growth in use of electric fences suggested rules for guidance in utilization of this equipment; this part of the code is new. Rules cover installation, use and identification of electric fences.

SECONDARY FUSING—Bulletin No. 45 of the Engineering Experiment Station, Oklahoma A. & M. College, Stillwater, Okla., is an expanded discussion of "Secondary Banking of Distribution Transformers" (ELECTRICAL WORLD, June 29, 1940, p. 36). Copies are available on request.

PAPER-INSULATED POWER CABLES—35 pages consist of general characteristics of paper insulation, information on copper conductors, paper insulation, lead sheath, specifications etc. Further information is given in the form of tables of decimal equivalents, temperature conversion and weights and measures. Copies are available by writing to the American Steel & Wire Company, Rockefeller Bldg., Cleveland, Ohio.

ASBESTOS INSULATED WIRES AND CABLES—General information is given on felted asbestos insulation, the general types and current-carrying capacities in this 48-page booklet. General description, finishes, colors, etc., of all-asbestos wires and cables and general description of AVC wires and cables, with the latter pages devoted to useful data needed in connection with this type work. Copies are available from the American Steel & Wire Co., Rockefeller Building, Cleveland, Ohio.

WEIGHTS AND DATA HANDBOOK—Practical and complete tables of weights and data on copper, brass and bronze products are given in this 171-page handbook. All weights are conveniently expressed in three significant figures. In addition to direct weights on standard alloys, conversion factors provide ready means for determining the weights of other or special alloys in any standard form. Engineers, draftsmen, estimators and designers will find it most interesting. The handbook is published by Revere Copper & Brass, Inc., 230 Park Ave., New York City.

How Fiberglas Insulated motors helped solve corrosion problem for chemical plant

HAVE YOU EVER wished you could get longer service from your electric motors?

Very likely you *can*, if you have them made with Fiberglas Electrical Insulation. For insulation is the key to the life of much electrical equipment.

Here is the story of a chemical manufacturing concern whose particular motor insulation problem was created by corrosive fumes.

Replacement of motor windings was a constant problem with them.

In one of their processing operations where motors are subjected to powerful fumes, the best they had ever been able to get out of their motors was less than 90 days of service.

Looking for a way to overcome this problem they specified a motor with Fiberglas Insulation. Did they get results? Although the nameplate has long since been eaten away, the motor is still going strong after more than a year.

Why This Motor Stood Up

The reason for the amazing performance of the Fiberglas Insulated motor is simple. The other motors broke down because the fumes attacked the insulation, thus causing it to short out. Fiberglas—because it is pure glass in fibrous form—resists corrosive fumes. Hence it could operate under these trying conditions.

Resistance to corrosion is just one of the many characteristics of Fiberglas Insulation which enables it to multiply the life expectancy of motors and generators. It is also highly resistant to *heat*. When impregnated it is impervious to *moisture*. (Naturally the individual fibers of *glass* can't absorb moisture). To top it off, Fiberglas has characteristics which help increase the safety factor under many conditions of overload!

Prove It To Yourself

So why put up with expensive repairs? Why suffer the excessive costs of interruptions caused by down time? Whatever your problem . . . no matter what type of electrical equipment you have . . . Fiberglas insulation should be able to help you.

Next time you have a repair job, or next time you order a new piece of electrical apparatus, *specify* Fiberglas Insulation. Then your own experience will doubtlessly make you want to standardize on Fiberglas.

Your electrical manufacturer or repair shop will be glad to give you Fiberglas Insulation if you *specify* it.

For full information write to Owens-Corning Fiberglas Corporation, Toledo, Ohio. In Canada: Fiberglas Canada, Ltd., Oshawa, Ontario.

OWENS-CORNING

FIBERGLAS*

*T. M. Reg. U.S. Pat. Off.

TOLEDO, OHIO

SPECIFY FIBERGLAS ELECTRICAL INSULATION

"NEVER SAW A CABLE TAKE PUNISHMENT LIKE AMERCLAD!"

ENGINEERS familiar with Amerclad find it hard to believe that anything made of rubber could be so tough. They've seen it dragged day after day through stony open-pit mines, run over by loaded mine cars, or exposed to water and grease and general machine-shop abuse. Yet it stubbornly resists damage, goes right on delivering power as though nothing had happened.

HERE'S AN INVITATION: Pick out your toughest portable cable job. Next time that cable needs replacement, replace it with Amerclad. You'll find that Amerclad has the stamina it takes to outwear your present cable. Often it outlasts two or three ordinary cables. And that means savings for you—both in replacement costs and lost time.

Amerclad owes its amazing toughness to a special rubber formula developed by years of research in the laboratories of the American Steel & Wire Company. Nothing but the finest Hevea rubber is used in its compounding. Its minimum tensile strength is 3500 lbs. per sq. in. Samples are required to stretch six times their own length before breaking. All Amerclad cables are vulcanized under enormous pressure, while encased in a heavy lead sheath that is afterward removed. This treatment bonds the rubber fillers and the jacket inseparably together to prevent tearing or stripping of the protective sheath.

AMERICAN STEEL & WIRE COMPANY **AMERCLAD**

IN THE MINES · ON ELECTRIC SHOVELS · FOR ELECTRIC TOOLS · FOR WELDING

Only genuine Amerclad Cables bear this identifying label, vulcanized right in the jacket. Make sure it appears on every cable you use in rough, abusive service.

AMERICAN STEEL & WIRE COMPANY

Cleveland, Chicago and New York

Columbia Steel Company, San Francisco, *Pacific Coast Distributors*

United States Steel Export Company, New York

UNITED STATES STEEL

MANUFACTURING - MARKETS

Refrigerator Sales Up 34%; Ranges, 36%

Domestic sales of household electric refrigerators in May amounted to 358,713 units, as compared with 315,935 in April, an increase of 13.6 per cent, and 254,805 in May, 1939, an increase of 40.7 per cent, according to the National Electric Manufacturers' Association. For the first five months, domestic sales totaled 1,431,605 units, as compared with 1,065,745 units in the corresponding period of 1939, a gain of 34.3 per cent.

World sales for May were 379,675 units, as against 331,049 in April and 272,787 in May a year ago. For the first five months, world sales totaled 1,505,911 units, compared with 1,141,848 units in the same period of last year, an advance of 31.9 per cent.

Electric range sales, as reported by NEMA for the U. S., Alaska and Hawaii, amounted to 42,983 units in May, as compared with 43,308 in April, a decrease of 0.75 per cent, and 32,000 in May, 1939, a gain of 34.4 per cent. For the first five months of 1940, sales totaled 195,327 as against 143,448 in the corresponding period of last year, an increase of 36.2 per cent.

•

Exports Gain 34% First Five Months

Electrical equipment exports for the first five months of 1940 totaled $58,222,623, as compared with $43,354,568 in the corresponding period a year ago, an increase of 34.3 per cent, according to the Electrical Division, Department of Commerce.

Foreign sales of electrical equipment in May were $12,089,165, compared with $11,811,777 in April, an increase of 2.3 per cent and with $8,973,606 in May, 1939, an increase of 34.7 per cent. No defined general trend was noticeable, trade fluctuations being numerous in both directions among the individual commodity categories. Outstanding among those showing an upward tendency were refrigerators, rubber-covered wire and several generator classes.

While May sales of a.c. generators totaled $155,919, as against $413,965 in April, shipments abroad of d.c. generators increased from $29,433 to $43,220.

•

General Electric Orders Show Continued Advances

Orders received by General Electric Company during the first six months of 1940 amounted to $212,653,314, as compared with $169,071,646 in the same period a year ago, an increase of 26 cent, according to President Charles E. Wilson.

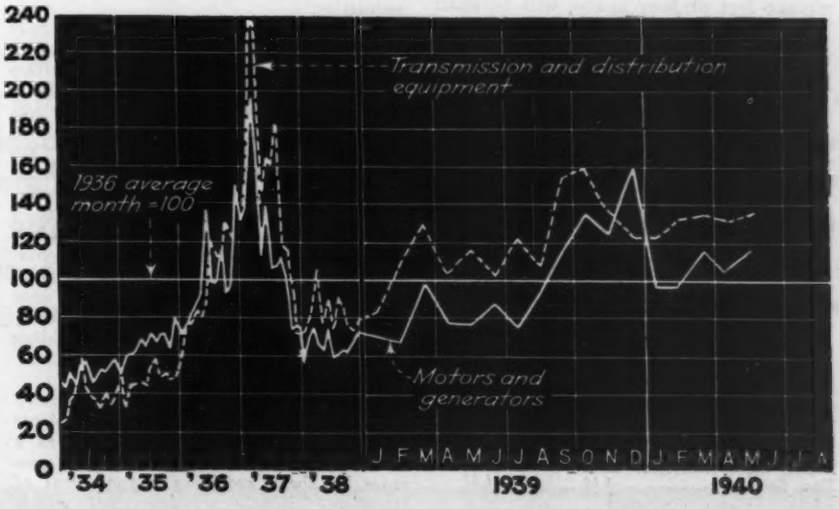
For the three months ended June 30, orders received were $115,163,267, compared with $97,490,047 in the first quarter and with $82,188,693 in the second quarter of 1939, an increase of 40 per cent. First quarter orders showed a 12 per cent increase over a year ago.

Electrical Orders at New 1940 Highs

Advances in orders received during May sent the NEMA indices for motors and generators and for transmission and distribution equipment to new highs for 1940.

For transmission and distribution equipment, the index rose to 135.7 from the revised April figure of 127.7, a gain of 6.3 per cent; the index was up 22 per cent over May, 1939. The index of orders received for motors and generators rose to 117.2 from the revised April figure of 107.1, a gain of 9.4 per cent. This figure was 51.2 per cent ahead of May a year ago.

Averaging the monthly index data for transmission and distribution equipment gives a figure of 130.3 for the first five months of 1940, as compared with 102.1 for the corresponding period of 1939 and with 115.5 for the entire year. For motors and generators orders the average is 107.1 for the first five months this year, as against 78.3 for the corresponding period a year ago, and 99.0 for the year 1939.



NEMA INDEX, value of orders received for motors (large d.c., polyphase, synchronous) and generators (engine, belt-driven); also for transmission and distribution equipment

Manufacturers Make New Appointments

George Campbell of Schenectady has been appointed manager of the Buffalo office of the General Electric Co. He succeeds George H. Calkins, who retired on July 1 after more than 41 years of service with the company. Also announced are the appointments of Ralph M. Darrin of Buffalo as manager of the Syracuse office, E. H. Aussicker of Binghamton as manager of the Schenectady local office, and E. B. Currie of Rochester as manager of the Binghamton office. Mr. Calkins was manager of the Buffalo office 33 years. Mr. Campbell, new manager at Buffalo, has been with General Electric since 1907.

Roller-Smith Co. announces the appointment of B. S. Woodman as a special representative. Mr. Woodman, who will be engaged in sales engineering, formerly was associated with the Wagner Electric Corp. Previous to his connection with Wagner, he was in the utility industry.

Easy Washing Machine Corp. has appointed C. M. Roberts as sales manager of the northern division with headquarters in Minneapolis, managing sales activities in Wisconsin, Minnesota and Iowa; D. C. Cunningham, sales manager of the southeastern division with headquarters in Atlanta; I. W. Shipp, sales manager in the southern division.

•

Paducah Announces New Curtis Plant

The Curtis Lighting Co., manufacturers of lighting fixtures, will erect a $175,000 general office and factory building at Paducah, Ky., with an annual minimum payroll of $200,000, Roy Prather, president of the Greater Paducah Association, announced. Minimum employment will be 200 persons. The company now has a large plant located in Chicago.

The plant, which will have 100,000 square feet of floor space, will be built as soon as Paducah carries out its part of the contract. No site for the factory has been selected.

The Greater Paducah Association has been negotiating with the company for relocation of its factory since Jan., 1939. Paducah was chosen over 250 cities in the South, Southwest and Pacific Coast area.

New York Metal Prices

	July 9, '40 Cents per Pound	July 2, '40 Cents per Pound
Copper, electrolytic	10.75*-11.00*	11.00*-11.50*
Lead, A. S. & R. price	5.00	5.00
Antimony	14.00	14.00
Nickel, ingot	35.00	35.00
Zinc, Spot	6.64	6.64
Tin, Straits	52.00	52.375
Aluminum, 99 per cent	19.00	19.00

*Delivered Connecticut Valley.

Field Reports on Business

Business in general has kept watch on day to day war developments across the Atlantic, especially on the Germany vs. Britain situation. Meanwhile, over here, consumer income has turned up to produce improved retail buying, thus rounding out the advance in business. Utility construction continues apace.

NEW YORK

Business in this area is responding to boosts in two directions. First, customers are asking for faster deliveries of orders on the books, and secondly, new orders are being placed. There are reports of increased utility buying of standard stock staples such as wire, cable, insulators, etc. so orders will be filled ahead of receipt of orders emanating from the Nation's defense program. Formal announcements, on the other hand, show utility construction is being speeded. Examples: Georgia Power to double capacity at Atkinson Plant; North American budget for 1940-41 up 50 per cent over figures established six months ago; Cleveland Illuminating to double capacity of plant under construction; Toledo Edison construction budget increased to five times normal outlay.

Electric output continues the 10 to 11 per cent increase over previous year which has prevailed since February 1.

Freight car loadings of 700,000 per week are a good 100,000 above a year ago, continuing the steadily increasing improvement which began in April.

Easing in commodity prices is attracting no undue notice as yet in New York, and the pause in steel production rate—the first in 10 weeks—has been expected as automobile industry demands began their annual decline.

In the defense classification largest project in June was the $15,000,000 powder plant of Tennessee Powder Company and other industries prominent in June construction for defense were utility plants (as already noted) oil refining, aluminum reduction, plywood factories, glass, and machine shops.

NEW ENGLAND

Contracts totalling over $245,000,000 were placed in this district by the Navy last week and in the neighborhood of $500,000 worth of electrical equipment was booked by both government and private industries.

Small motor sales kept their steady trend despite an intervening holiday. One manufacturer reports several notable group purchases, among which are three 50-hp. motors for compressors, several small lots aggregating from 100 hp. to 200 hp. and a few motor-driven pumping units; another representative records sales of large lots of fractional horsepower motors during the past fortnight and points to a rapid increase in loom motor sales. Switch and control apparatus buying is encouraging; last week circuit breaker sales of one manufacturer amounted to over $25,000, while another states that activity for automatic safety switches is holding up very well among the centers of machine tool building.

Flood-lighting as an important contribution to the protection of power plants and industries in this district and as a necessary part of the national defense program has been receiving a good deal of attention. Nearly all important power plants in this district are at present provided with flood light units and many industrial plants are now being equipped, according to one distributor who reports more than a dozen installations in which 500- and 1000-watt lights have been used. Nine Massachusetts air-ports are to be enlarged and improved as part of the national defense scheme and a good volume of lighting equipment and wiring supplies will be required.

CHICAGO

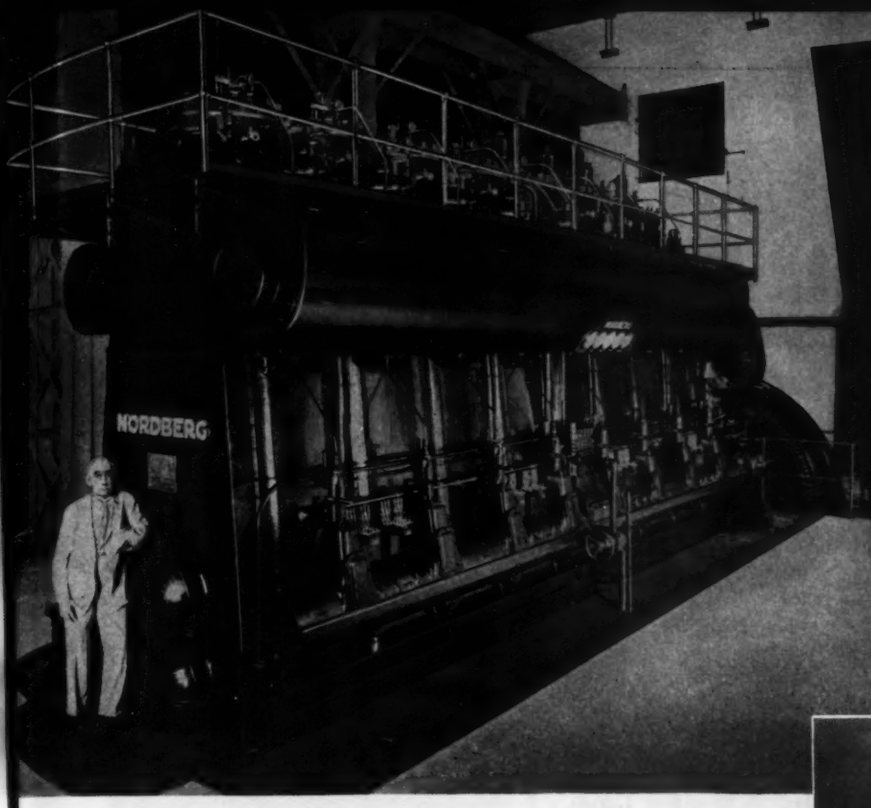
Developments during the past week reveal business activity continuing a widespread advance. Industrial production held front rank in the picture as army and navy awards stepped up the tempo. Rebounding from the holiday week operations in the Chicago district steel mills increased to 95 per cent of capacity. Fairbanks, Morse & Company was awarded a contract for five sets of submarine propelling machinery totalling $870,000. Other defense program contracts awarded to firms here amounted to $172,596, including $95,689 for telephone and switchboard equipment and $10,067 for steel conduit.

Orders for electrical equipment during June showed moderate declines from May. Of 26 electrical manufacturers reporting June sales to the Electric Association 14 showed an increase over May while twelve had decreases. Practically all, however, registered gains for the six-month period over last year. Inquiry reveals a considerable number of orders pending but commitments have been withheld because of uncertain conditions.

Telephones in use on June 30 showed a gain of 1,274 over May and 37,501 over June 1939. Employment in this district during June advanced 12 per cent over a year ago while wages increased 20 per cent. Residential construction has fallen off moderately during the past few weeks but remains nearly double the volume a year ago. Industrial plant expansion continues to show marked improvement and utility construction forges steadily ahead.

PACIFIC COAST

Aircraft factory expansion is reflected in Boeing's order for $35,000 Pyranol transformers from General Electric at Seattle. Private capital is investigating a one million dollar conservation dam near Los Gatos, California. Industrial business includes $15,000 circuit breakers and transformers for an Hawaiian sugar plantation; a 156-kva. engine generator; and a 250-hp. motor and equipment costing $7,500 for conveyor work. Power companies report considerable load increases from lumber mill additions, plus that from new plants being built to meet lumber demand. Other private construction includes a $500,000 San Francisco brewery addition, a flour mill for Oakland, and a 7-million-gallon winery near Fresno. Grand Coulee business includes $34,542 for twelve 500-kva. and six each 100- and 50-kva. American transformers; $21,550 for three 230,000-volt and one 115,000-volt 1,200-ampere Bowie disconnect switches, and $19,890 for four Westinghouse lightning arresters.



BERMUDA

Meets the need for greater capacity by installing a

NORDBERG DIESEL

From a small 300 K.W. semi-Diesel unit to a modern 8250 K.W. multi-Diesel engined central station in less than twenty years, briefly tells the story of the growth of the Bermuda Electric Light, Power and Traction Company at Pembroke, Bermuda. Every few years another unit had to be installed to care for the rapidly growing load, until today there are eight engines in all, the latest addition being a 3180 horsepower, eight cylinder, two-cycle, mechanical injection Nordberg engine, by far the largest unit in the plant.

Isolated as is this generating station and being the sole source of electric service for the island, dependable performance is doubly important. It is for such applications where faithful service and low operating costs are given first consideration that Nordberg has won an outstanding position in the Diesel engine field.

The 3180 horsepower Nordberg Diesel engine is installed in the newly built extension to the power house at Pembroke, Bermuda.

When contemplating added generating capacity, particularly units of larger size, investigate the merits of Nordberg Diesels. In addition to engines for operation on oil, there are also dual fuel burning engines for oil and natural gas for localities where the latter fuel is available.

NORDBERG MFG. CO., MILWAUKEE

NEW YORK WASHINGTON CLEVELAND KANSAS CITY DALLAS LOS ANGELES

NEWS ABOUT PEOPLE

Arkansas Power Elects Three Vice-Presidents

Election of three new vice-presidents of the Arkansas Power & Light Co. was announced by Harvey Couch, president, following the June meeting of the board of directors.

This honor was conferred on W. E. Baker, treasurer, Pine Bluff; Capt. Frank M. Wilkes, general manager, Pine Bluff; R. E. Ritchie, assistant to the president and manager of the Little Rock division.

Mr. Baker joined Mr. Couch when the latter was organizing and developing a telephone system in Louisiana about 1911. Later he worked for Mr. Couch in the Louisiana Creosoting Co. and the Valley Land & Timber Co., with offices in Winnfield, La. In 1915 he moved to Arkadelphia, where the offices of the Arkansas Light & Power Co., predecessor of the Arkansas Power & Light Co., were located. Subsequently he went to Pine Bluff and became auditor. He was elected treasurer in 1922 and is also a director of the company.

Mr. Wilkes joined the power company organization in 1919. Following graduation from the Kentucky State University in 1908, he took a shop course with the Western Electric Co., and then became associated with the Public Service Co. of Northern Illinois. In three years he was district superintendent of construction. Then he joined Public Service Co. of Central Illinois, going from there to the Missouri Public Utility Co. as manager of the Poplar Bluff district. Following the World War he joined the Arkansas Power & Light Co. as commercial manager, and was soon promoted to operating superintendent. He then became general superintendent and in 1927 was made general manager and elected a director.

Mr. Ritchie has been with the power company since 1923. He worked first as chief clerk to J. L. Longino, who was then vice-president and general manager, and in 1927, he was made assistant to the president, Mr. Couch. In 1935 he was made manager of the Little Rock division.

Three other promotions in the power company were also announced shortly after the elections. Q. C. Shores, who had been assistant to President Couch, was made executive assistant to the president and executive vice-president. J. L. Bodie, auditor, was promoted to assistant secretary and assistant treasurer. Charles T. Evans, who had been doing special promotional work, was made special assistant to the president.

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► L. L. CRUMP, vice-president and chief engineer of the James R. Kearney Corp., St. Louis, has been named chairman of the St. Louis section of the American Institute of Electrical Engineers. For a number of years Mr. Crump has been actively engaged in the power field. He has been connected with the Kearney Corp. since 1931. Mr. Crump is secretary of the technical committee, distribution cutout group of the National Electrical Manufacturers Association; a member of the joint E.E.I.-N.E.M.A. distribution cutout group, and active in the St. Louis Electrical Board of Trade.

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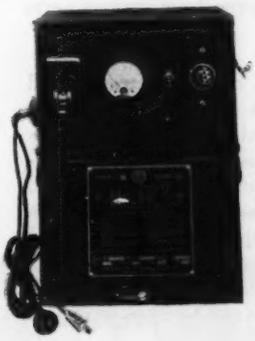
Chandler Made Secretary of Consolidated Edison

Melville T. Chandler has been elected secretary of the Consolidated Edison Co. of New York. Mr. Chandler took office on July 1. He succeeded Frederick W. Jesser, who retired last month with more than fifty-one years of service to his credit—the dean of all company employees in the electric side of the business.

Mr. Chandler joined United Electric Light & Power Co., one of the predecessors of Consolidated Edison, in 1915 as an office boy. Serving in the engineering department, he later became head of the statistical department. In 1930 he

ELECTED VICE-PRESIDENTS—(l. to r.) W. E. Baker, treasurer, Pine Bluff; Capt. Frank M. Wilkes, general manager, Pine Bluff; R. E. Ritchie, assistant to the president, Little Rock, who have been elected vice-presidents of the Arkansas Power & Light Co.

AMERTRAN TRANSFORMERS



Portable set designed to permit laboratory tests on transformer oil in the field — AmerTran Type TS-6D.

Heavy Duty test set for the commercial laboratory, utility or manufacturer; 10 Kva., 100 Kv.— AmerTran Type TS-10A.

The importance of dielectric tests on insulation and equipment at regular intervals and with *dependable* apparatus cannot be overestimated. Such tests not only are your best insurance for uninterrupted service but also are essential for the protection of human life and valuable property.

For four decades many leading electric utilities, equipment manufacturers, universities and testing laboratories have depended upon AmerTran for high-voltage testing apparatus. During this time our engineers have thoroughly studied testing problems of all types and have developed transformers and complete sets for both light- and heavy-duty testing. Standard designs are available to meet the most specialized requirements of the research worker, commercial testing laboratory, maintenance man and electrical manufacturer.

Consult with AmerTran on all problems involving equipment for testing electrical insulation, whether it be paper, tape, oil, rubber and pressboard in the pre-fabricated state or in assembled products such as motors, generators and cable. Let us submit complete data on apparatus for your needs.

AMER TRAN

AMERICAN TRANSFORMER COMPANY

178 Emmet St., Newark, N. J.

AMERTRAN

was made assistant secretary and the next year became secretary. When the United was consolidated with New York Edison Co., he became assistant secretary of the latter company, and when that in turn was merged into Consolidated Edison in 1936, he was made as-

M. T. Chandler

sistant secretary of the new company and manager of the general office service department.

After serving with predecessor companies, Mr. Jesser became assistant secretary of New York Edison in 1920 and secretary in 1924. On the merger of New York Edison into Consolidated Edison, he became assistant secretary of the latter company and was elected secretary in 1938.

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▶F. J. A. McKittrick, in charge of trade relations for the General Electric Co., recently retired after 44 years of service with the company. W. M. Stearns, manager of special contracts, has been appointed manager of trade relations and special contracts, with W. A. Sredenschek as assistant manager. G. P. Vest will succeed Mr. Sredenschek as assistant to Vice-President Shreve, assuming responsibility for the sales training and placement of technical graduates. Mr. McKittrick's extensive experience with General Electric has included the managing directorship of the Australian General Electric Co., managership of General Electric Supply Corp. in Buenos Aires, New York sales managership of the foreign department of the General Electric Co. and later he served in the same capacity for International General Electric Co. In 1924 he was appointed manager of Canadian department of General Electric at Schenectady and since 1936 he has served in the industrial department supervising Canadian sales and doing trade relations work. Mr. Stearns has been identified with General Electric in Fort Wayne, Atlanta, Pittsfield and Schenectady. Mr. Sredenschek, who joined the company in 1921, was appointed assistant to the vice-president in charge of sales in 1936 and given the added responsibility for the placement of all technical graduates within the company, continuing his duties as supervisor of sales training.

▶Byron R. Adkins, superintendent of the municipal light plant at Jasper, Ind., has resigned. Joseph P. Kunkel has been named acting superintendent.

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S. R. Sellers to Direct Kelvinator Range Sales

Steele R. Sellers has been appointed sales manager of the electric range department of the Kelvinator division of Nash-Kelvinator Corp. Mr. Sellers, who succeeds Harry M. Parsons, resigned, brings a vast amount of experience to the Kelvinator range-sales position. He

has been directly connected with the household appliance industry since 1916.

For the past eighteen years he has been in public utility merchandising work. Before going to Kelvinator he was with the West Penn Power Co., where he served as merchandising manager.

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▶A. E. Snyder, formerly general sales manager, has been appointed assistant general manager of the Westinghouse lamp division with headquarters in New York, according to an announcement by D. S. Youngholm, vice-president of the Westinghouse Electric & Manufacturing Co. B. H. Sullivan, formerly manager of the lamp division's Middle Western district with headquarter's at Chicago, Ill., succeeds Mr. Snyder as general sales manager, with headquarters in New York. Leon S. Paletou, formerly manager of the Southern district with headquarters in Atlanta, Ga., becomes manager of the Middle Western district at Chicago, and Charles A. Conklin, manager of automotive products sales for the lamp division with headquarters in New York since 1938, succeeds Mr. Paletou. R. E. Ebersole, formerly New York Metropolitan branch manager for the Northeastern district, succeeds Mr. Conklin. Robert A. Corvey, formerly New England branch manager for the Northeastern district, succeeds Mr. Ebersole as metropolitan manager.

▶Brooks Faxon, for the past 36 years manager of the New England district for the Wagner Electric Corp., with headquarters in Boston, has retired, and has been succeeded by Howard W. Petty, lately manager of the company's Buffalo territory. Mr. Faxon was educated at Harvard University, and his earlier electrical industry connections included terms of service with the Stuart-Howland Co., Boston wholesalers of many years ago, and the Simplex Wire & Cable Co., Cambridge. He became one of the best-known figures in the manufacturing field in the eastern area. Mr. Faxon's important contributions to Wagner development were recognized at a recent dinner in Boston, at which a gold watch was presented to the guest of honor by associates in the company from various parts of the country.

▶Paul J. Kiel has been transferred from Chase Brass & Copper Co. to Kennecott Wire & Cable Co. as cable sales engineer with headquarters at the company's general office at Phillipsdale, R. I. Both companies are subsidiaries of Kennecott Copper Corp. Mr. Kiel was graduated from Annapolis in 1925 and has specialized in wire and cable work continuouslv since 1927.

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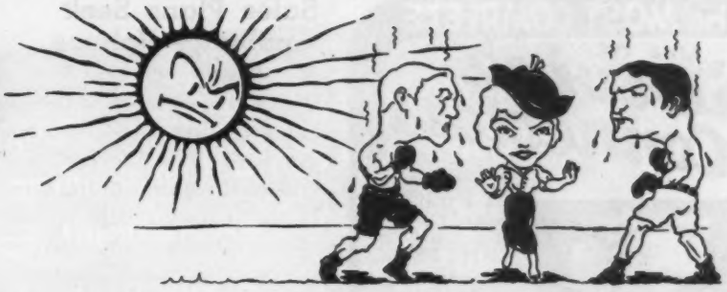
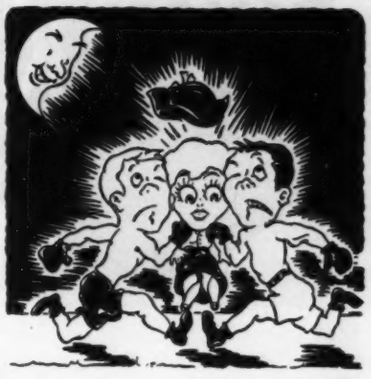
OBITUARY

▶Walter A. Townsend, advertising manager of the Springfield division of the Central Illinois Light Co. for the past 24 years, died June 1, after an illness of ten days. Mr. Townsend was born in Marblehead, Mass., in 1873. He was educated in public schools in Boston and later graduated from the City of London College, London, England. When he returned to the United States he embarked on a newspaper career, during which he held editorial positions with a number of metropolitan papers.

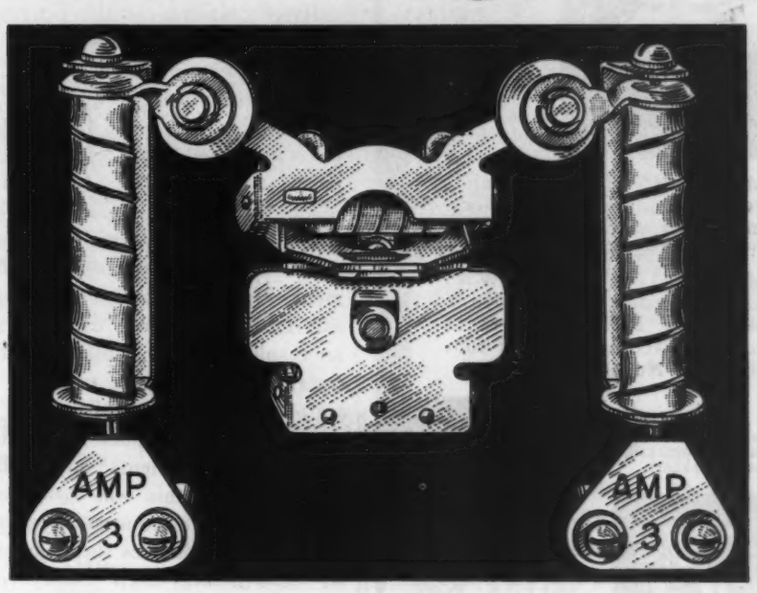
THE HEAT'S ON!



but it's only the weather, so the boys behave

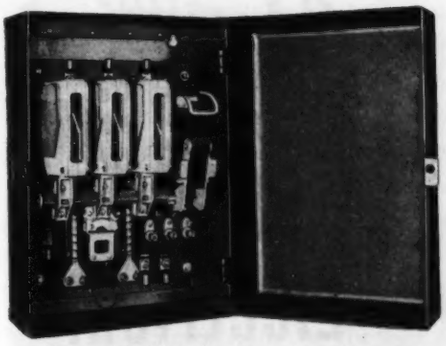


When it comes from within...SOCKO!



Unlike other thermal starters, outside temperatures have no effect on the *Monitor Temperature Compensated Thermaload.* The operating elements keep their distance regardless of the Thermometer because ambient heat affects all parts alike . . . They move in the same direction and stay apart.

BUT—when the heat's on from within—when overload or single-phasing causes excessive current to flow in the series-connected heater elements—That's different! No longer can the cool pretty miss in the middle move away from the hotly advancing power elements on each side . . . The squeeze is applied, she is knocked off her feet and—*click!* . . . You've got your motor disconnected from the line.



Type 6333 AA2 showing automatic reset Thermaload installed.

The temperature-compensated thermal overload device is an exclusive Monitor feature. We like to talk about it. Write us today.

Monitor Controller Company

Gay, Lombard & Frederick Sts.
BALTIMORE, MARYLAND

Monitor TEMPERATURE COMPENSATED Thermaloads

The MOST COMPLETE LINE OF
Service Connectors

LARGEST VARIETY of types, and a COMPLETE range of sizes. For all kinds of conductors.

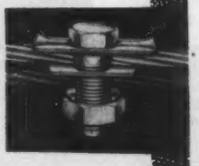
Popular connector at left is carried in stock in ALL sizes, up to 1,000,000 CM. Furnished with or without retainer.

ANY MATERIAL — Hardware Bronze, Silicon Bronze, Aluminum.

MILLIONS IN USE and never one rejection due to performance or workmanship. Can be re-used over and over.

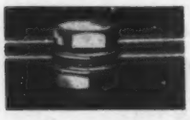
MADE IN OUR OWN PLANT under engineering supervision. Bodies and nuts precision machine-threaded for perfect fit. No sharp edges.

ALUMINUM Connectors machined from hard drawn rod, with forged spacers.



SERVICE POST Connectors for one or more conductors; many types.

SERVICE ENTRANCE Connectors with extruded copper bodies, Everdur screws.



TELEPHONE Service Connectors, brass rod—plain, nickel plated or tinned.

AND THOUSANDS MORE. Every connector Dependable. Preferred by leading utilities and "industrials," and manufacturers of electrical equipment.
Write for Catalog.

PENN-UNION ELECTRIC CORPORATION
ERIE, PA. *Sold by Leading Jobbers*

PENN-UNION
Conductor Fittings

Sales Plans Seek Appliance Volume

[*Continued from page 61*]

25 per cent or more of the salesman's compensation is derived from commissions.

A final word as to the arrangement of the following data may be advisable, particularly in connection with the basis on which commissions and bonuses are paid.

It will be noted that these two terms are used in different ways by different companies, but it was considered desirable in the interests of accuracy to report here the replies from utility companies in the form in which they were received.

Secondly, it would be helpful to have more details on each plan, with particular reference to payments made for major appliance sales. It will be noted that most consistent reference is made to this type of payment. Major appliances are of interest not only because of their appliance sale profit possibilities but also because of their large usage of kilowatt-hours. It is for this reason that, when companies reported commission and bonus payments on appliance sales volume, this was so reported. However, when companies specified the major appliances the characteristic of which is high usage, entries were shown under kilowatt-hour usage. Finally, where E.A.R. bases were reported, entries were shown in the E.A.R. terms.

Basic data presented by utilities follow. First, we give the company number and location; second, the method of compensation; third, the average annual income of the salesman; fourth, the portion of this income which is received from commission and bonuses. The final statement for each company relates to the basis of payment for these commissions and bonuses:

1. Eastern—Commission, $15 drawing account; $1,700 annual income.

2. Southern—Salary and commission, $1,920 total; $1,020 from commissions; load building bonus of $6.50 on a range, $6.50 on the water heater, $5 on the refrigerator. In addition a small appliance bonus. If the selling price is from $1.49 to $3, the payment is 50 cents. From $3 to $7 pays 75 cents and from $7 to $30 pays $1.

3. Urban Midwest—Commission and bonus, $2,700 total; 33 per cent from bonus. Load bonus of $5 on a range, $4.50 on a water heater, 50 cents on roasters.

3. Rural Midwest—Salary, commission and bonus; 50 per cent from commission and bonus and a load bonus of $1 on the brooder, $5 on the range, $4.50 on the water heater and 50 cents on the roaster.

READERSHIP THAT MAKES YOUR
ADS WORK

Another Important Reason Why
Good Advertising Pays in
Electrical World

Two more top-flight companies join the "galaxy of stars" who are proud to proclaim the essential role Electrical World has played in their success formula. Meaning one very significant thing—that good advertising does pay in this publication. It always has. Study the advertising technique of these leader concerns. You'll find in every single case that strong selling copy has been used in Electrical World CONSISTENTLY and over a period of many years. There's your formula for advertising results.

G. & W. ELECTRIC SPECIALTY COMPANY of Chicago has used ELECTRICAL WORLD—regularly, forcefully, effectively — from the earliest days of its commercial life to the leadership position it occupies today. George P. Edmonds, General Manager, feels no hesitancy in attributing a real part of G. & W.'s success to ELECTRICAL WORLD. His letter, in addition, points to a highly important though frequently neglected phase of advertising performance:

"Selling ideas in a technical field isn't easy; the general tendency is to let somebody else try it first. But we know that engineers read Electrical World with the confidence that it gives them reliable and useful information. We believe that applies to the advertising as well as the editorial content. Therefore, the impressions created through consistent advertising, consciously or unconsciously, lead to acceptance and sale of our products.

"Thirty years of steady advertising in Electrical World has unquestionably contributed materially to the recognition we enjoy and the sales successes we have won."

LAPP INSULATOR COMPANY of LeRoy, N. Y., launched its WORLD program back in 1917. The fine industry position this company enjoys is due, in no small part, to the consistency and real excellence of this advertising. Brent Mills, Sales Manager, confirms this in the following significant words:

"We have always been well pleased with the results of our advertising in Electrical World.

"I believe such a statement coming from us means a little more than from many organizations, because all our advertising is carried out with a definite objective in mind. Seldom, indeed, do we run an ad just to run an ad. During the many years that we have used Electrical World there have been several specific tasks for our advertising to perform, and the degree to which we have succeeded in attaining these objectives constitutes a very satisfactory indication of the effectiveness of our work.

"We know that Electrical World has done its part of the job in a most gratifying manner."

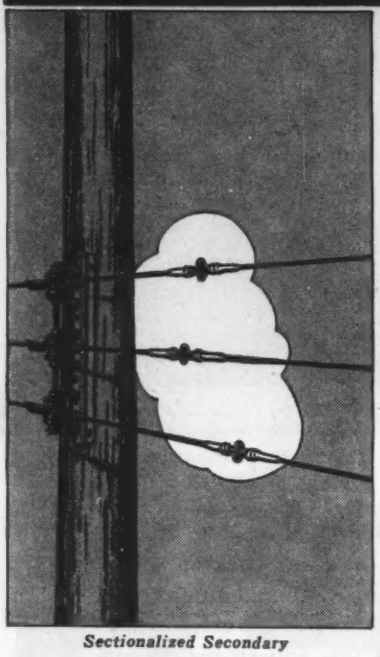
ELECTRICAL WORLD

Serving a Huge and Ever-Growing Market

A McGraw-Hill Publication, 330 W. 42nd St., N. Y. C.

No. 8 of a series of factual messages designed to demonstrate that GOOD ADVERTISING *in a leading business publication will invariably produce worth-while sales results*

modernize
YOUR
DISTRIBUTION
PRACTICE—



Sectionalized Secondary

RELIABLE
STRAIGHTLINE
INSULATED
SPLICES

For sectionalizing secondaries, secondary banking, for series street lighting—wherever a break is needed in the line.

Consist of two Straightline Dead End units attached to an insulating section of strong and tough plastic which has high dielectric strength and will not carbonize nor absorb moisture.

Targets are slipped on insulating section for easy identification of break from ground.

Reliable
ELECTRIC COMPANY
OVER 30 YEARS SERVICE TO THE UTILITIES
3145 CARROLL AVENUE · CHICAGO ILLINOIS

4. Southwest—Salary and commission, $2,100 total; 72 per cent from commission. Commission and bonus paid on basis of appliance sales volume.

5. Midwest—Salary, commission and bonus, $1,800 total, with 33 per cent for bonus, 50 per cent from commission. Pays $5 bonus on ranges, $3 on refrigerators, $8 on water heaters. An additional 8 per cent general commission is paid for range and for a range and water heater combined 10 per cent. Extra bonus annually of 50 cents for all appliances sold between 50 and 74 per year, or 75 cents for all appliances numbering between 75 and 99, and of $1 for every appliance over 100.

6. Southwest—Salary and bonus, $1,584 total; small proportion from commissions. A bonus on special campaigns based upon sales volume or estimated annual revenue.

7. Eastern—Salary and commissions, about 12 per cent resulting from commissions, this in turn dependent upon appliance sales volume.

8. Central—Salesman is billed for merchandise at about cost, then pays all expenses of selling, installing, servicing and advertising.

9. Southwest—Salary and commissions, $2,580 total; $1,470 from commissions. A bonus on ranges, water heaters, refrigerators. A commission of 2½ per cent on first $1,000 of sales per month and 5 per cent paid on all excess.

10. Central—Salary and commission, $1,800; bonus on company and dealer estimated annual revenue.

11. Southwest—Salary only, $1,700.

12. Eastern—Salary and commissions, $2,200; 25 per cent from commission. Bonus on range, water heater, and refrigerator.

13. Eastern—Salary and commission, $2,040; 45 per cent from commission. Bonus on range, water heater and refrigerator. 5 per cent commission on small appliances.

14. Midwest—Salary and commission, $2,040 to $2,100; 45 per cent from commissions. Bonus on load and difficulty of selling appliances.

15. Western—Salary and commissions, $2,300; 56 per cent from commissions and bonuses. A water heater bonus from $3 to $15 plus 2 per cent commission on sales price of appliances.

16. Midwest—Salary and commission, $2,700; 75 per cent from commissions.

17. Southern—Salary and commission, $890, junior; $1,815, senior; 19 per cent from commissions for the junior salesmen and 34 per cent from commissions for the senior salesmen. Salesmen pay their own transportation expenses.

18. Eastern—Salary and commission, $2,600, with 60 per cent from commissions.

19. Southwest—Commission only; total compensation amounts to $1,920-$2,100.

20. Southwest—Salary and commission, $2,400, about 12 per cent from commissions.

21. Western—Salary and commission, $2,100, 24 per cent from commissions, plus campaign bonuses.

22. Southwest—Salary and commission, $1,500, with 20 per cent from commissions, plus 9 per cent on sales made above the basic sales quota.

23. Southwest—Salary and commission, $1,680, with 82 per cent of the compensation coming from commissions, plus a load bonus, plus 10 per cent on net sales.

24. Southwest—Salary and commission, $1,600, with 15 per cent coming from commissions. Salesmen work to an E.A.R. quota and thereafter receive a bonus on the volume of sales.

25. Central—Salary and commission, $1,700; very small proportion from commissions and a bonus paid during special campaigns.

26. Midwest—Salary and commission, $2,000, about 50 per cent from commissions. Commissions in turn are based upon ranges, refrigerators and water heaters.

27. Western—Salary and commission, $2,280, about 35 per cent from commissions.

28. Western—Salary and commission, $1,866, 13 per cent from commissions; a bonus paid to salesmen on dealer sales also. (This is true in many other companies even though not specifically mentioned).

29. Midwest—Salary and commission, $1,800, 40 per cent from commissions.

30. Western—Salary and Commission, $2,840, 44 per cent from commissions. "Promotional salesmen" in this company are on a $2,500 salary.

31. Midwest—Salary and commission and bonus, $1,680-$1,980, with 40 per cent from commissions, plus a commission on miscellaneous appliance sales, plus a bonus from the sale of designated load builders.

Keeping Down Costs for Service Continuity

[*Continued from page 53*]

improvement in each case have equal value.

Furthermore, the cost to the power company of making the 50 per cent reduction appears to be of the same order of magnitude in either case. During the past fifteen years remarkable reductions have been made in customer outage time, in some cases as much as 90 per cent. It is virtually impossible to tell from the records how much this has cost since the rates have actually come down during the same period; the result of continued improvements in equipment and methods. The data exhibited in the accompanying figures indicate quite strongly, however, that each time a 50 per cent reduction in outage time is made, the total cost of service increases only 2 per cent or 3 per cent (corresponding to a 3 to 5 per cent increase in investment). Thus, although the cost per kilowatt-hour increases rapidly as perfection is approached, the incremental cost of service improvement may still be quite reasonable.

Probability of Overloads

In order to secure a higher loading factor on equipment and still maintain the desired continuity of service, it is necessary to analyze the relation between equipment breakdowns, load characteristics and probability of serious overloads.

BUILDING NEW CELL STRUCTURES?

Check these advantages of J-M Trancell

1. *DRY*
2. *LIGHT IN WEIGHT*
3. *RUSTPROOF*
4. *EASILY INSTALLED*
5. *LOW IN COST*

NO WATER is needed for erection of J-M Trancell. Supplied in large, easy-handling sheets, Trancell is installed rapidly at low cost. Its light weight permits cell structures to be built on upper floors or balconies with no danger of overloading.

OF course, cell-structure materials must be strong, durable and fireproof, but the five characteristics listed above are also vitally important. In J-M Trancell all these advantages are combined.

Compare Trancell with concrete.

Trancell comes in large, ready-to-use sheets . . . is easily installed with ordinary tools. Construction is entirely dry. And because Trancell is light in weight, equipment can be housed on upper floors and balconies without overloading.

Compare Trancell with metal.

An asbestos product, Trancell cannot rust. Shutdowns for cleaning or painting are minimized. Furthermore, with Trancell condensation troubles are greatly reduced. Being fireproof and rigid, it confines oil fires to the cells in which they originate. And, because of Trancell's low heat conductivity, adjacent equipment is protected against transmitted heat.

• • •

Full details will show you how you can add new safety and economy to your station with housings and doors of J-M Trancell. Write for brochure DS-426. Johns-Manville, 22 East 40th Street, New York, N. Y.

AN ASBESTOS PRODUCT, Trancell is 100% fireproof. Strong and durable, it is highly resistant to warpage, cracking and chipping—maintenance is virtually eliminated.

Johns-Manville TRANCELL

An Asbestos Product for Better Cell Structures and Doors

for high compression at low torque

● There's no such thing as slippage inside the new streamlined Fargo "6000" Connector. At low torque its vise-like grip holds conductors in perfect, permanent contact. Fargo high compression at low wrench torque assures maximum pressure between conductors with less possibility of damage to threads. That's one reason why you can expect extra years of service and more repeat use from Fargo "6000" Connectors. Now available in No. 6 and No. 4 sizes, with other sizes available later.

MADE BY FARGO MFG. CO.
DISTRIBUTED BY
LINE MATERIAL CO.

With this knowledge it is possible to obtain the best economy through the highest loading consistent with good service. Many customer interruptions are caused by reasons other than a shortage of spare capacity, and this frequently makes possible an improved ratio of load to capacity without appreciable service hazard.

Reference to the accompanying graph of segregated interruptions shows that the 22-kv. overhead lines and the 4-kv. circuits are responsible for a large share of the interruptions. Some information will therefore be presented which has been useful in determining the safe loading limit in these two cases.

Distribution Circuit Ties

Most large loads are supplied by two or more 22-kv. lines, some of which are double circuit. Originally, spare capacity was provided to permit carrying the peak load with a double-circuit line out. It was soon found, however, that this practice, together with provision for growth and the use of convenient units of capacity, would result in a rather low average ratio of load to capacity.

The curves of line outages and circuit overloads show the probabilities of various overloads taking into account typical seasonal and hourly distribution of breakdowns and loads. The curves are flexible in application, being based on one circuit interruption per year. The first step is therefore to determine from experience how many tripouts may be expected from all the circuits feeding the load. The next step is to calculate the effective capacity remaining with one circuit out of service, taking into account the distribution of load between the other lines and any other pertinent factors.

The example shows how such an analysis may be used to co-ordinate reliability and to distribute the investment in a manner to secure the best results. Similar guides could no doubt be prepared to cover other portions of the system.

The other example of how an analysis of equipment reliability and load characteristics may throw considerable light on the problem of reserve capacity is shown on the graph of overload probabilities. It is common practice to establish tie switches between radial distribution circuits in order to facilitate maintenance and also to re-establish service during feeder outages. The latter use raises the question of how much reserve capacity should be provided in the feeders because of the possibility of carrying a portion of an adjacent circuit during peak load periods. Many factors have to be taken into account and the results shown on the graph are rather startling.

On the basis that each circuit is tied to two adjacent circuits, there is a theoretical possibility of a 50 per cent overload if a feeder fails at the time of peak loads on all three circuits involved. There are, however, many factors which minimize this chance. For example, failures occur infrequently and these usually on the branches. Most breakdowns occur in the summer when loads are usually lightest. Furthermore, most outages are too short to permit the necessary switching to pick up the load on adjacent circuits. It can thus be seen that the possibility of overloads arising from carrying adjacent circuits should, in general, cause very little, if any, reserve capacity to be included in feeders.

•

New Power System Planned by Turkish Government

A contract of approximately £1,500,000 has been placed by the Turkish Government institution, the Eti Bank, with the Metropolitan-Vickers Electrical Export Co., Ltd., London, for the construction of a power station at Catal Agzi. Initial installation will consist of three 20,000-kw. turbo-generator sets, Babcock & Wilcox, Ltd., boilers and coal-handling equipment, switchgear, transformers, transmission line and substations. Provision is to be made for an extension.

The plant will furnish power for the modernization and expansion of the Turkish coal industry.

•

Russian Hydro Project

The Russian Government plans a huge hydro-electric development on the upper Volga River, calling for construction of two great dams which will change the course of the historic stream and create a lake covering 5,000 square miles. The development will be near Kazan, capital of the Tartar Republic, a city which will be completely rebuilt. The 27 towns and villages in the area to be inundated will be moved.

Recent Rate Changes

SPRINGFIELD GAS & ELECTRIC CO. has reduced its electric rates 12 per cent, according to an announcement by the Missouri Public Service Commission. The reduction it is estimated will save Springfield light users $150,000 a year.

EASTERN SHORE PUBLIC SERVICE CO. has made a new revision in its electric rates, which is estimated to save domestic and commercial customers approximately $29,000 a year. This is the third reduction the company has made since 1934. The Virginia Corporation Commission, which announced the reduction, said rate reductions amounting to more than $21,000 a year were affected by negotiations with the company in 1934, pertaining to the same class of customers. In November, 1938, there were additional reductions of approximately $20,000 annually.

TUCSON GAS, ELECTRIC LIGHT & POWER CO. has filed with the Arizona Corporation Commission a new rate schedule estimated to save electric and gas consumers $128,000 annually.

QUEENS BOROUGH GAS & ELECTRIC CO. has been denied by the New York Public Service Commission permission to alter several of its rate schedules and instead adopted a recommendation by Milo R. Maltbie, chairman, requiring the company to put into effect, temporary demand rates which will result in the saving of about $10,000 a year for general service and retail power customers. The new rates, which became effective July 1, will remain effective pending a determination by the commission of permanent rates in the classifications affected.

ELLENSBURG, WASH., has announced that the new rate schedules for light and power furnished by the municipal plant will become effective August 1, providing average reductions of between 35 and 40 per cent, totaling approximately $55,000 a year. The most drastic cut ever made by the city drops the rate for residential lighting from $3.50 for the first 100 kw. to $2.50. The average cut in residence lighting, including the schedule for small users, runs about 20 per cent. The commercial light and power rates provide for savings, in some cases, up to 50 per cent.

•

Plan to Buy Undecided

Negotiations for the purchase of the light and water works of New Mexico Power Co. at Albuquerque are still open, despite the statement of the utility that its facilities are not for sale, according to Dave Carmody, City Council president.

•

Huntsville Bonds Issued

Public offering has been made of a new issue of $1,750,000 city of Huntsville, Ala., 2¾ per cent and 3 per cent revenue anticipation bonds dated July 1, 1940, and maturing July 1, 1943, to 1960. The state finance department recently authorized the issue in connection with the purchase of the distribution system of the Alabama Power Co. The city will use TVA power.

Pennsylvania's
UNI-ROW
RADIATORS

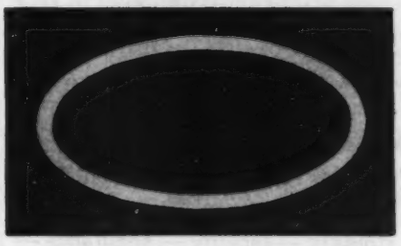
prove a vital factor in lower installation and maintenance costs. Their distinctive advantages have gained the favorable acceptance of engineers and operating executives throughout the industry.

Permanently Welded

Uni-Row radiators are permanently welded to the tanks, and are as durable as the tanks themselves. This construction eliminates valves, flanges, gaskets and bolted connections, all of which ordinarily require periodic attention.

Readily Accessible

Each tube of a Uni-Row radiator is easily accessible for sand-blasting, cleaning and painting, by brush or spray, in factory or field, thus offering the utmost in convenience.



Strong and Sturdy

Tubes are of 13-gauge steel, tested at 100 lbs. per square inch. (Illustration shows cross-section approximately 4/5 actual size.) Each tube has uniform opening throughout its entire length, affording free circulation of oil.

TOMORROW'S TREND TODAY IN TRANSFORMERS

Pennsylvania's construction is costlier, yet you pay no more for its advantages!

Pennsylvania
TRANSFORMER COMPANY

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Hot Rolled Copper Rods • Bare and Tinned Strand
Bare and Tinned Copper Wire
(In Rounds, Flats and Squares)
URC Weatherproof Wire
Cotton, Paper and Asbestos Magnet Wire
(In Rounds, Flats and Squares)
Rubber Insulated Wires and Cords
Lead Covered Cables • Multiconductor Power Cables
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ROME-60
That New, Tough, 60% Jacketed, Heavy Duty Portable Cable

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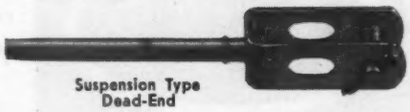
Nicopress **SUSPENSION DEAD-ENDS are Built to Withstand Vibration.**

Completed Nicopress Suspension Dead-End



Suspension Type Dead-End

No. 41 Nicopress Tool

Because of their strength — security — endurance — ease of installation — long life and low cost — you'll declare these dead-ends just the thing for copper, copperweld or steel distribution lines. And Nicopress Dead-Ends must always stand up under vibration tests that equal or surpass any that they would be subject to under rigorous field conditions. They are designed to permit the loaded conductors to go *straight thru without bending*, thus minimizing the danger of breaking, and they provide for tail of any desired length. They are light and strongly built, assembled all in one unit for ease of installation.

THE NATIONAL TELEPHONE SUPPLY CO.
5100 Superior Ave. Cleveland, Ohio
Canadian Mfr.—N. Slater Co., Ltd., Hamilton, Ont., Canada. Export Distributor — International Standard Electric Corp., New York, N. Y.

Technological Security Stressed at A.I.E.E. Forum

[*Continued from page 65*]

capable of 32-volt operation, *per se*, is greatly needed. Conversion equipment now required complicates the use of these lamps. The series booster and vibrator-inverter are useful. One road uses 24-in. tubes in series with 60-watt incandescents at 110 volts d.c. and is experimenting with other combinations (Norfolk & Western).

It was brought out that there is a field for Diesel-electric equipment to supplement electrified rail service in case of damage to power plant and overhead systems from bombing. Such units deserve consideration in a preparedness program.

E. W. Brandenstein (General Electric) stated that a unit weight of 80 lb. per hp. at the rail has been attained in an electric locomotive capable of 90 m.p.h. and suited to either passenger or freight service. Substation transformers for 25 cycles are so reliable that no duplicates are necessary. In many cases single transformers 15 miles apart suffice. Trolley potentials above 12 kv. increase locomotive costs in excess of substation capital savings.

Mr. Wright said substation costs may run to $35,000 per mile in typical cases. The cost of installing a single-phase substation for an electrified road runs from $10 to $15 per kva. Simpler designs of structural steel supports for railroad overhead systems are coming into use.

Standards

Rating of Potential Devices and Suggested Material for a Standard. By J. E. Clem (General Electric) and P. O. Langguth (Westinghouse).

Capacitance potential devices are canvassed and proposed standard requirements suggested in detail.

Some Problems in the Standardization of Temperature Ratings of Fractional-horsepower Motors. By C. G. Veinott (Westinghouse).

Presents statistical comparative data on methods of temperature measurements. Recommends surface thermocouple method be differentiated from thermometer methods to accord with practice. Effect of voltage variation discussed.

A Study of Short-time Ratings and their Application to Intermittent Duty Cycles. By R. E. Hellmund and P. H. McAuley (Westinghouse).

Discusses a method of applying short-time ratings to intermittent service. Gives proposed formula for on-time minutes in

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Provide dependable anchoring when poles are subjected to unusual strains from storms. Made of tough, certified, rust resistant, malleable iron for extra strength and holding power. Write for new bulletin.

EVERSTICK ANCHOR CO.
FAIRFIELD, IOWA

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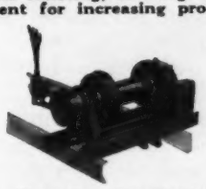
WINCHES
DERRICKS • CRANES
FOR PUBLIC UTILITY TRUCKS

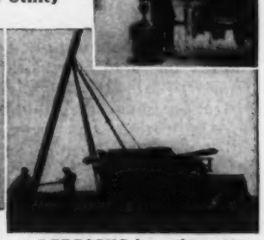
Gar Wood offers the most complete and dependable Hoisting, Hauling and Handling Equipment for increasing productive truck hours.



There is a Gar Wood WINCH to fit the job—a type for every Utility requirement.

CRANES for rapid handling of sewer, gas, water pipes, machinery and transformers.

HYDRAULIC REPAIR TOWERS for street light and power line maintenance.



DERRICKS for pole setting. Four sizes for 35' to 65' poles.

Bulletin W140A sent on request. Advise character of work to be done.

GAR WOOD INDUSTRIES, Inc.
MINER DIVISION
7838 Riopelle Street
DETROIT • MICHIGAN

terms of ratio of running time to total time per cycle.

Effect of Load Factor in Operation of Power Transformers by Temperature. By **V. M. Montsinger** (General Electric).

Load factors which result in fastest aging are used to determine permissible peak loads which can be carried safely with no more deterioration of insulation than results from continuous operation at rated kva. Conclusions, 3 per cent overload for each 10 per cent system L.F. is below 100 per cent. Curves given for combined effect of L.F. and ambient.

Reference Values for Temperature, Pressure and Humidity. By **P. L. Bellaschi** and **P. H. McAuley** (Westinghouse).

Advocates rationalization of these reference values toward standardization and thus avoid the confusion which attends the present non-uniform practice.

Comment stressed increasing acceptance in the face of limited scepticism of the thermocouple as a supplementary method of ascertaining temperature rise. In 231 induction motor (single-phase) tests the rise by thermocouple was 47 deg. C., against 40 deg. by thermometer, and in another case 24 deg. difference by resistance measurement was cited. Underwriters favor thermocouple use as above. A new maximum allowable temperature rise of 60 deg. C. was suggested for consideration.

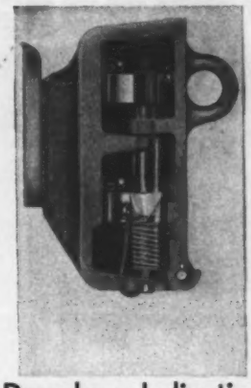
It was pointed out that there is no need of maintaining so many short-time ratings of motors as now exist. Temperature rise is the basic element in rating rather than torque. The value of continuous load tests as criteria of intermittent duty cycle fitness was questioned.

L. A. Hill (Allis-Chalmers) seconded the effectiveness of Montsinger's method. The 8-deg. rule allows temperatures to be increased without much reduction in life. It might be advisable to introduce a factor of safety range here.

Conference on Standards

An informal conference on standards was held during the convention, under the chairmanship of R. E. Hellmund, with the objective of encouraging wider participation by Institute members in such activities. The discussion primarily covered methods of rating and testing apparatus for short-time loads and centered upon electric welding equipment.

Resistance measurement of temperature rise in duty cycle runs of welding generators gives a true index of



Dropdown Indicating
MATTHEWS CUTOUTS.

SAFER,
if closed in on short because it is tripfree.

COOLEST,
because of good old fashioned pressure-area contacts. Contacts free from radio noise.

PATENTED SLACK REMOVER,
will automatically take up 3/8 inch of slack fuse link which prevents false outages, and burned contacts.

ALWAYS INDICATES
when fuse link parts—even if door is frozen shut. See drawing below.

NORMAL TENSION
on link is less than 2½ lbs., therefore over-stressing or breaking of links is impossible.

THIS IS THEIR THIRD
year on the market and thousands are in successful service.

Try Them At Our Risk.
Write For Complete Bulletin.

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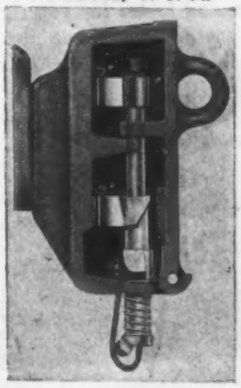

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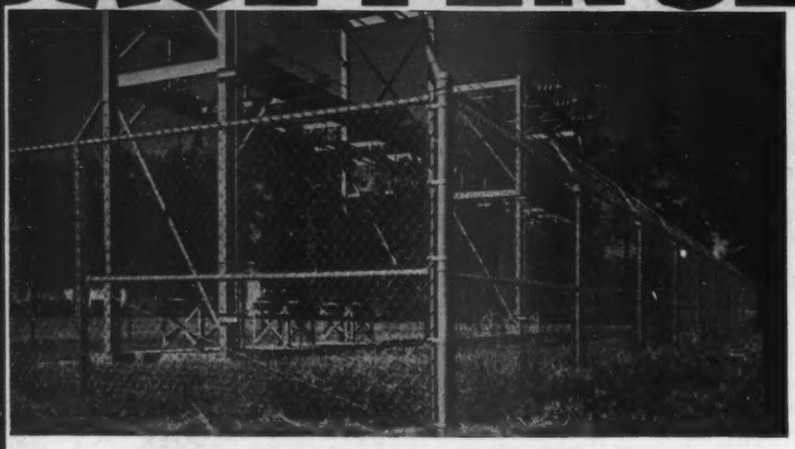

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● When you talk to a Page engineer you'll learn much about fence metals: heavily galvanized copper-bearing steel, Armco ingot iron, Alcoa aluminum, Allegheny stainless steel. Only Page makes fence of all these reputable metals. He will consult with you as to the one best suited to your needs. And he will tell you about Page's exclusive winged channel posts. You'll also learn about superior fence erection, for he is one of 97 factory-trained, responsible local distributors. Write PAGE FENCE ASSOCIATION, Bridgeport, Conn., Atlanta, Chicago, New York, Pittsburgh or San Francisco for Page Fence Book and name of nearest qualified member of the association.

A PRODUCT OF PAGE STEEL & WIRE DIVISION—AMERICAN CHAIN & CABLE COMPANY, INC.

America's First Wire Fence—Since 1883

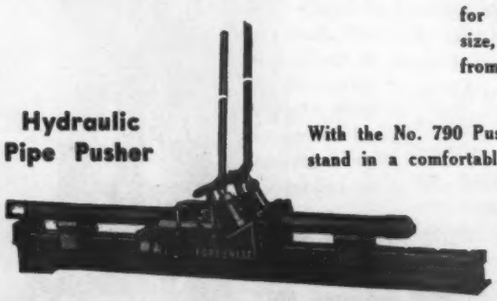
GREENLEE TOOLS...TO HELP YOU CUT YOUR COSTS

If you want to lower your labor and material costs on future jobs why not do as so many satisfied users have, and use the Greenlee Hydraulic Pipe Pusher or the Hydraulic Conduit Bender. The Hydraulic Pusher will eliminate costly trenching, back filling and tearing up of pavements, and will result in a considerable saving in labor costs for you. The Hydraulic Bender will make smooth even bends easier and faster for you right on the job, saving enough on the first few jobs to more than pay for itself.

Hydraulic Pipe Bender

Hydraulic Benders for rigid conduit are made in two sizes. The No. 770 for conduit from 1¼ to 3-inch size, and the No. 775 for conduit from 3 to 4½-inch size.

Hydraulic Pipe Pusher



With the No. 790 Pusher shown here, one man can stand in a comfortable position and push pipe from 1¼ to 4-inch size, simply by pumping the levers. A No. 795 machine is made to push larger sizes of pipe and drainage ducts.

GREENLEE TOOL CO., 1705 Columbia Ave., ROCKFORD, ILL.

operating conditions and aids securing optimum use of apparatus. Data on five machines tested showed the following excess of temperature measured by resistance over that measured by thermometer at the coil surface wi,th multiple layer windings: 20 deg. C.; 17-42 deg.; 18-38 deg.; 17-20 deg. Desirable procedure takes account of (1) rating welders on the basis of the load cycle, which is studied in terms of root mean-square currents; (2) temperature measurement at the end of continuous runs, preferably by the resistance method; (3) determination of temperature rise limits allowable.

Glass insulation was briefly discussed as a material of growing popularity. Its cost was given as 7 per cent above Class "A" insulation, which was declared satisfactory for general purpose motors, which are less limited by temperature rise than by other factors.

•

Energy Tax Increased

New defense taxes which went into effect on July 1 included a tax of 3½ per cent on electrical energy, increased from 3 per cent.

•

Utility Petitions Filed with Board

Arkansas-Missouri Power Corp. has filed an application with the SEC regarding the issuance and sale of $2,350,000 of 4 per cent first mortgage bonds, series A, due 1965, and $300,000 of 3¾ per cent serial notes. Proceeds from the sale of these securities, together with other funds of the company, are to be used for the redemption at 100 and accrued interest, of $2,707,725 of 5 per cent first mortgage bonds, series A, due 1957.

Eastern Shore Public Service Co. (Delaware) has filed a registration statement on Form U-5-B, the complete form for registration under the Holding Company Act.

Application has been filed regarding the proposed acquisition by California Public Service Co. of certain properties and assets of Central Mendocino County Power Co. of Willits, Calif., for $235,000.

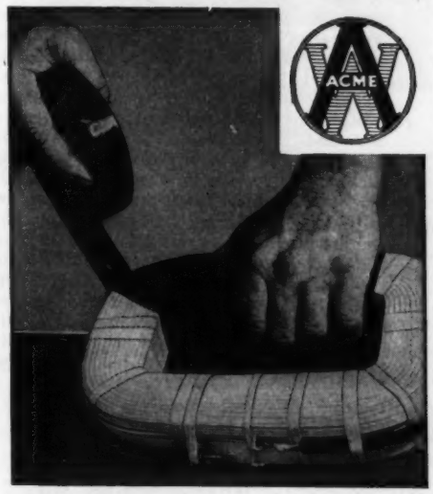
SEC has announced the filing of an application covering the purchase by Sioux City Gas & Electric Co. of all of the outstanding common stock of Nebraska Public Service Co., consisting of 10,000 shares having a par value of $50 a share. The stock is to be purchased from Iowa Public Service Co. for $350,000. Iowa Public Service Co. will use the proceeds from the sale of the stock for additions and improvements to its properties.

HOW TO MAKE A LITTLE MONEY GO A LONG WAY!

One of a quantity of poles treated with OSMOPLASTIC by Alabama Power Co. in 1935.

INVEST a little money in OSMOPLASTIC GROUNDLINE TREATMENT (cost only $1 to $2 a pole, including labor) and extend service life of your standing poles 7 to 10 years! Experience of more than 50 leading utilities proves that a little money invested in OSMOPLASTIC will go a long way toward protecting your investment in standing poles. Treatment is simple as A-B-C and requires no pressure or heating equipment whatever, yet its effectiveness is definitely established by years of actual field service. Write for literature.

OSMOSE WOOD PRESERVING CO.
of AMERICA, Inc.
General Offices, 1437 Bailey Ave., Buffalo, N. Y.



Bias Tapes with

PLENTY OF STRETCH!

THEY fit snugly into all corners and crevices. Their exceptional flexibility and tensile strength are due to an Acme developed process of applying pure vegetable oil varnishes of Acme formula to highest grade cotton fabrics. Offered in bias or straight tapes, and in rolls up to 36" wide —yellow or black. Samples if requested.

The Acme Wire Co., New Haven, Conn.

Acme Wire Products

VARNISHED INSULATIONS — MAGNET WIRE
COILS — CAPACITORS

Municipal Plants

HOT SPRINGS, N. M.—Informed that the village and the New Mexico Public Service Co. have reached an agreement for a substantial lowering of electric rates, Judge George W. Hay has issued an order refusing to issue to the village a certificate of convenience and necessity permitting it to install its own electric distribution plant. Both the village and the company stipulated that such an order should be issued. The court's action ends a controversy of more than a year. Judge Hay in effect approved a five-year contract, effective July 1. The village previously had planned to sell revenue bonds to finance construction of a plant to distribute electricity generated at Elephant Butte Dam. It let a contract for construction of the plant for approximately $145,000, before discovering a certificate of convenience and necessity was required. The order issued by the court indicates that the parties to the action accepted terms recommended by the court. Following is a comparison of new and old rates: New residential service, first 35 kw.-hr., 6 cents per kilowatt-hour; next 65 kw.-hr., 4 cents per kilowatt-hour; over 100 kw.-hr., 2 cents per kilowatt-hour. Old residential, first 30 kw.-hr., 10 cents per kilowatt-hour; next 70 kw.-hr., 4 cents per kilowatt-hour; over 100 kw.-hr., 3 cents per kilowatt-hour. Minimum $1.50, unchanged. New commercial service—First 100 kw.-hr., 6 cents per kilowatt-hour; next 200 kw.-hr., 5 cents per kilowatt-hour; next 300 kw.-hr., 4 cents per kilowatt-hour; next 900 kw.-hr., 3 cents per kilowatt-hour; over 1,500 kw.-hr., 2 cents per kilowatt-hour. Old commercial service, first 100 kw.-hr., 9 cents per kilowatt-hour; next 100 kw.-hr., 7 cents per kilowatt-hour, over 200 kw.-hr., 5 cents per kilowatt-hour. Minimum $1.50, unchanged. Heating, automatic power, general and municipal power rates were cut materially.

AMHERST, OHIO—Ninth District Court of Appeals recently upheld the validity of an $80,000 bond issue for construction of a municipal light plant in a taxpayer's suit. The Ohio Public Service Co. supplies energy to the city's publicly owned distribution system. The Appellate Court upheld a decision by Lorain County Common Pleas Judge Guy B. Findley three months ago. The electric power plant is being constructed as a PWA project.

NORTH BALTIMORE, OHIO—Village council has refused to make an agreement with the Central Ohio Light & Power Co. to have a "stand still" agreement for a period of one year on the question of whether or not the town shall eventually have a municipal electric plant. The armistice was suggested by A. W. Conover, vice-president and general manager of the utility, because of the lengthy controversy on the subject of municipal ownership of the electric facilities in the village. Mr. Conover suggested the armistice because "the present war situation has created a crisis in this country, which has placed extra and unexpected demands upon all industry and upon the entire citizenry of the nation."

SCHULENBURG, TEX.—City Council has plans maturing for extensions and improvements in electrical distribution system, now being acquired from Central Power & Light Co. for municipal operation in future. Bonds for entire project have been authorized. Modernization and expansion estimated to cost about $40,000. Garrett Engineering Co., 918 Richmond Road, Houston, Tex., is consulting engineer.

200 Ampere, Catalog 275

Compact

A New Jersey engineer had the fallacious idea that he couldn't get eighteen 400 ampere disconnecting switches in an available space of 21 feet.

Then he learned that Matthews Disconnecting Switches were only 3⅞ inches wide in the 200 and 400 ampere ratings and only 4¾ inches wide in the 600 ampere rating, and that they are all rated 7500 volts. His problem was solved and he had ample space to do a neat job.

This is their tenth year of successful service. Thousands are in use all over the country. Send for Bulletin 500-A.

Do you want to examine a sample? It will be sent prepaid on request, on loan account.

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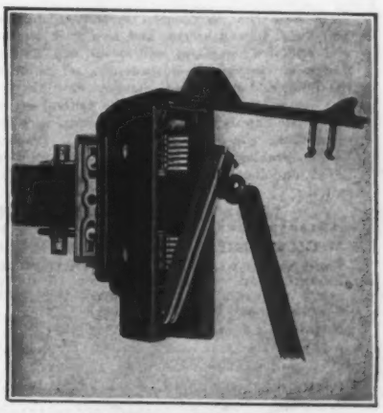

600 Ampere, Catalog 675

The Only Clamp-Type Ammeter which measures both A.C. and D.C.

Given their choice, your men will select a Tong Test in preference to any other clamp-type ammeter. With it they can measure both A. C. and D. C. accurately and safely without breaking the circuit. This feature not only saves time, but increases production.

Secondly, Tong Test is the only instrument of its kind which can not burn out under overload because it contains no windings. Last, but not least, Tong Test's instantly interchangeable meter dials are furnished to meet your exact needs and each dial contains only one set of large, easily read numerals.

Tong Tests are available in eight standard ranges for measuring up to 800 amperes A. C. and 400 amperes D. C. Get the facts on this money-saving instrument by sending for a copy of the Tong Test bulletin.

COLUMBIA ELECTRIC MFG. CO.,
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TONG TEST AMMETERS

NEW BOOK

Electric Distribution Fundamentals

Just Out

SHOWS HOW TO SOLVE

the problems of design, construction, operation, service, methods, equipment, mechanics, and materials of electric distribution

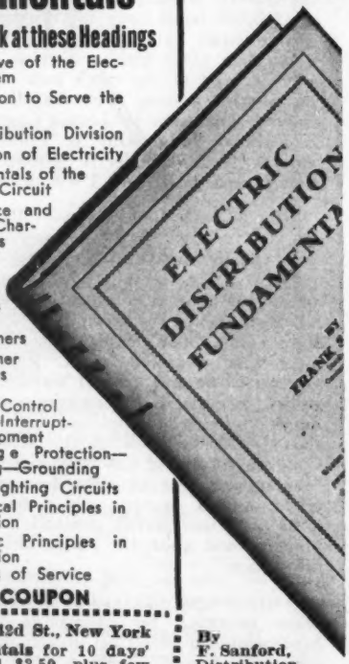
From a non-engineering viewpoint, this book outlines features of both utility distribution and the industrial and inside wiring branches of service to the outlet.

THE ABC OF ELECTRIC DISTRIBUTION

Tells how the distribution system is designed and built, how it works, and how it is serviced and operated; explains equipment and its use, design of carrying lines, problems of maintaining flow, and materials; discusses how distribution fits in economically with the general system of electric supply; covers voltage drop, wire size calculation, power factor, etc., etc. Practical design problems are included with solutions based on diagrams instead of difficult mathematics.

Look at these Headings

- Perspective of the Electric System
- Distribution to Serve the Load
- The Distribution Division
- Generation of Electricity
- Fundamentals of the Electric Circuit
- Inductance and Related Characteristics
- Tools for Electrical Problems
- Transformers
- Transformer Connections
- Voltage Control
- Current Interrupting Equipment
- Voltage Protection—Lightning—Grounding
- Street Lighting Circuits
- Mechanical Principles in Distribution
- Economic Principles in Distribution
- Measures of Service



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BOOK REVIEWS

Electric Distribution Fundamentals

By Frank Sanford. Published by McGraw-Hill Publishing Co., Inc., 330 West 42d St., New York, N. Y. 242 pages, illustrated. Price, $2.50.

Books written for the design engineers and those charged with economical administration of electrical distribution are numerous, but many are too advanced for the linemen, testmen, power sales engineers of the same utility company. Yet many companies have found it desirable to provide courses of elucidation for such employees who sought an insight into the fundamental physical principles of the power business. This book is an outgrowth of just such a course and should be of unique aid in either self-study or in the guided lessons of company educational programs. It has about as little mathematics in it as possible and still deal with power factor and the quirks of three-phase systems.

Practical Electric Metering

By M. F. Smalley, A. N. Prentice, H. E. Buck, W. J. Wright, C. L. Lucal, R. V. Kelch, G. K Bernhard. Published by John Wiley & Son, Inc., 440 Fourth Ave., New York, N. Y. 228 pages, illustrated. Price, $2.75.

Seven Ohio Power Company metermen here have set down what they feel other metermen need to know about watt-hour and demand metering and they do so in elementary terms. All of six and parts of several others of the fifteen chapters are devoted to a.c. circuit rudiments as foundation for the simple vector and connections treatment of energy meters and instrument transformers. The emphasis generally is on vector study of the behavior and correctness of meters on their single- and polyphase-load circuits. Naturally algebra and trigonometry cannot be avoided, but the book is by no means a mathematical one. Problems are limited in number and introcacy and no answers are given, so the book lends itself better to directed instruction for the beginner. Little emphasis is placed on the structural details of commercial meters, nor on the standard technique and administration of a meter department, because the aim is to explain how things work and work correctly. It was elvolved from a typical course conducted within utility educational circles. Considerable analytical attention is given to polyphase thermal demand meters.

48 Million Horses

By Humphrey B. Neill. Published by J. B. Lippincott Co., East Washington Square, Philadelphia, Pa. 241 pages. Price, $2.50.

Here is the saga of electric power in popular romantic style with no attempt at technical rigor. In following the evolution of the General Electric Company, it likewise traces into home, industry and transportation the indispensable ramifications of the electric age. Wide reading of its epic portrayal will come too late to thwart the current assault of reformers upon the whole electric fabric, but not too late to deflect future unmindful efforts to focus attention away from the wholesome wonders of the electrical engineer and the electrical fabricator. Admittedly it glorifies the accomplishments of a single manufacturing contributor and its galaxy of explorers, but in so doing it merely typifies the philosophy of the whole industry intent on rendering service to mankind.

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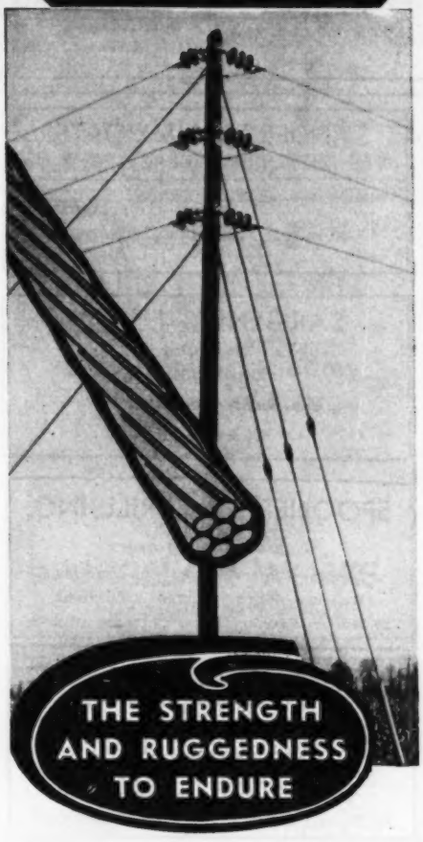

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War Cuts Energy Demand in Britain

Despite increase in munitions work, the "black-out" and curtailment of non-essential industries have caused a substantial reduction in the aggregate maximum demand on the Central Electricity Board, and it appears improbable that any material increase will take place during the war, according to the twelfth annual report of the board.

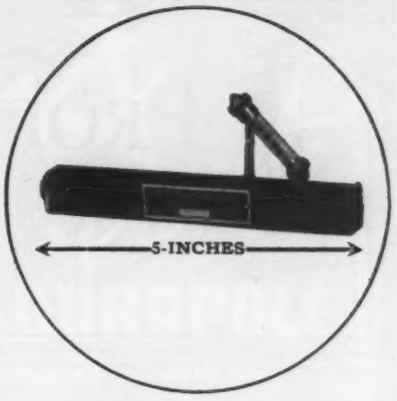
As a result, the completion of the plant expansion programs for 1940 and 1941 and the modified program for 1942 will result in an increasing margin of spare generating plant as the war proceeds, it is stated. In addition, it is believed probable that the post-war recovery in demand will not be such as to reduce that margin to normal peace-time proportions until some years after the cessation of hostilities.

While the war has resulted in the omission of much detailed statistics from the current report, it is reported that at the end of 1939 the Grid comprised 4,430 miles of transmission lines, 3,039 miles of which operated at 132 kv. and the remainder at 66 kv. and lower voltages, and 307 switching and transformer stations with an aggregate transformer capacity of 10,971,000 kva. The number of "selected stations" remained at 137 and their installed capacity totaled 8,658,000 kw., as compared with 8,264,160 kw. at the end of 1938, according to the report.

Consideration is being given to the application of a new type of 33-kv. lightning arrester to the Grid and Petersen coil equipment has been extended to further lower-voltage sections. Modernization of 132-kv. circuit breakers was continued, with an additional installation of 132-kv. high-speed, low-oil-content circuit breakers put in service.

Anti-dirt insulators for transformer and circuit breaker bushings and cable terminals at certain substations where the atmosphere is polluted proved entirely free from flashover in their first year of operation. Straight-through joints of the compression type and clamps of either the compression or snail type are being adopted for all new Grid lines.

Protective equipment operated on many more occasions than in previous years and correctly cleared 91 per cent of the faults, the highest percentage yet recorded. Three-core cables have been adopted for 66-kv. service, as well as a reduction in thickness of dielectrics. Internal-nitrogen-filled 132-kv. cable laid in 1937 has proved satisfactory and two additional lengths have been ordered. A new form of 66-kv. external-nitrogen pressure cable was also ordered.



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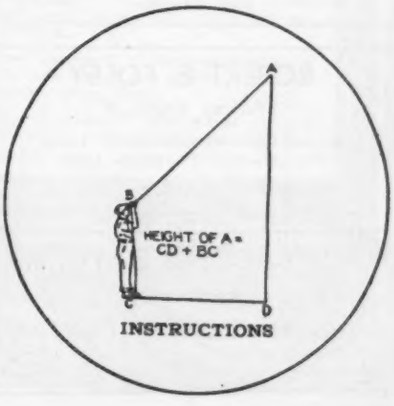

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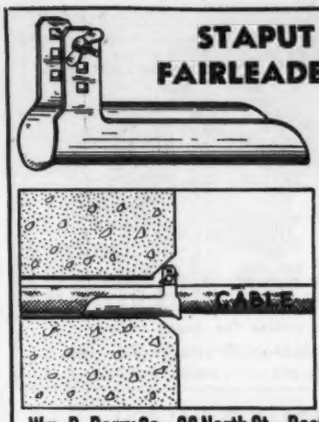

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GREEN BAY, WIS. — Wisconsin Public Service Corporation, Milwaukee, plans new 66,000-volt transmission line from Green Bay to De Pere, Wis., with power substation for terminal connection at latter place. Permission has been secured and work is scheduled to be carried out soon.

MARCUS HOOK, PA.—American Viscose Corporation, Delaware Trust Building, Wilmington, Del., plans installation of motors and controls, regulators, switchgear, conveyors and other equipment in connection with expansion and modernization of viscose rayon mill at Marcus Hook. Cost estimated close to $1,000,000, with majority of fund to be expended for machinery and equipment. Work will be carried out at early date under direction of company engineering department. Similar equipment also will be installed at branch mills at Meadville, Pa., and Nitro, W. Va., where extensions and improvements will be made, including new units for increased capacity. Cost of latter projects reported over $300,000. Ballinger Company, 105 South Twelfth Street, Philadelphia, Pa., is architect and engineer for last noted work.

PORTLAND, ORE.—Administrator, Bonneville Project, Department of Interior, 811 N. E. Oregon Street, Portland, receives bids until July 26 for 2500-kva. transformers and spare parts (Circular 1185). Also, until July 22, for motor-driven, deep-well pumping unit, complete with pressure tank and fittings (Circular 1187).

WATERLOO, IOWA—City Council plans extensions and improvements in street-lighting system in west side business area, requiring about 26,000 lineal feet of parkway cable, quantity of potheads and miscellaneous equipment. Proposed to carry out work soon. C. T. Wilson is city engineer.

TEKAMAH, NEB.—Burt County Rural Public Power District, Tekamah, E. D. Beck, superintendent, plans extensions in primary and secondary lines in parts of Burt, Thurston, Dodge and Washington Counties, totaling about 200 miles, with outdoor power substations and service facilities. Cost estimated about $275,000. Financing has been arranged through Federal aid. Permission has been granted and work will proceed at early date.

BURBANK, CALIF.—Vega Airplane Company, Burbank, plans installation of power substation and facilities, motors and controls, duct lines, switchgear, conveyors, electric hoists and other equipment in new local plant on 30-acre tract of land near Union Air Terminal, recently acquired. Plant will comprise several one and multi-story units, totaling about 275,000 square feet of floor space. Work will begin soon and is scheduled for completion by close of year. Cost estimated close to $3,500,000, of which approximately $1,500,000 will be expended for machinery and equipment. Company is a subsidiary of Lockheed Aircraft Corporation, Burbank.

DENVER, COLO.—Bureau of Reclamation, Denver, receives bids until July 22 for four 500-kva., 110,000 to 7200/12,470 Y-volt, single-phase, 60-cycle, oil-immersed, self-cooled, outdoor-type transformers; one 7200/12,470 Y-volt, three-phase, four-wire, 600-amp., outdoor switching and metering unit; one 115,000-volt, 600-amp., three-pole, manually-gang-operated disconnecting switch; one 15,000-volt, 200-amp., three-pole, manually-gang-operated, outdoor-type, horizontal-mounting, disconnecting switch;

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4—250-kva., Moloney, 7800/220/440 volts.
4—200-kva., Pittsburgh, 7800/220/110 volts.
2—200-kva., General Electric, 2200/220-440 volts.
3—200-kva., General Electric, 13,800/230/460 v.
3—150-kva., Pittsburgh, 6600/440 volts.
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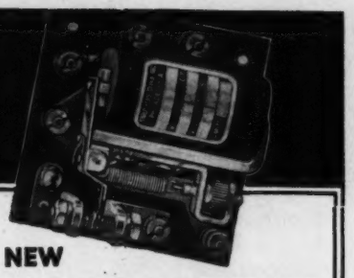
COST ENGINEER—Experience includes full charge of original and reproduction cost determinations of complete electric and gas properties, both in connection with new uniform classification of Accounts and Rate cases; expert witness before commissions; and Utility plant design and construction, all totaling twenty years. Now employed. PW-776, Electrical World, 520 N. Michigan Ave., Chicago, Ill.

ACCOUNTANT AUDITOR Treasurer. Age 39 Christian. Married. Extensive experience in all branches of utilities including management operation and construction desires permanent and responsible connection. Best references. Salary moderate. Available about August 15th. PW-778, Electrical World, 330 W. 42nd St., New York, N. Y.

METER and RELAY Engineer. Six years active experience with large industrial plant. Age 31. Technical training. Now employed. Consider change. PW-779, Electrical World, 330 W. 42nd St., New York, N. Y.



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MITCHELL, S. D.—Northwestern Public Service Company, Huron, S. D., has plans under way for expansion and improvements in steam-electric generating plant at Mitchell, including installation of new generating unit and auxiliary equipment. Cost estimated close to $150,000. Work will be placed under way at early date. Walter J. Dixon, Medical Arts Building, Mitchell, is architect.

BURBANK, CALIF.—City Council, H. I. Stites, city manager, receives bids until July 23 for furnishing and delivering ten-unit, indoor-type, metal-clad switchgear assembly and complete auxiliary equipment (Specifications 215). Public Service Department, 174 South Magnolia Boulevard, in charge.

WALLA WALLA, WASH.—Continental Can Company, 100 East Forty-second Street, New York, N. Y., plans installation of motors and controls, duct lines, regulators, switchgear, conveyors, electric hoists and other equipment in new branch can-manufacturing plant at Walla Walla, where large tract of land recently was acquired. It will comprise a main one-story unit and several auxiliary buildings, totaling about 125,000 square feet of floor space. Cost reported over $500,000. Contract for erection has been let to Austin Company, 16112 Euclid Avenue, Cleveland, Ohio, and work will be placed under way at once.

PORTSMOUTH, VA.—Bureau of Yards and Docks, Navy Department, Washington, D. C., plans extensions and improvements in power distribution system and lighting facilities in shops at Norfolk navy yard, Portsmouth, for which fund of $70,000 has been authorized. Also will install power equipment and facilities in new addition to machine shop at yard, estimated to cost $600,000; additional weight-handling and transportation equipment, to cost about $175,000. This is part of development program at yard during fiscal year 1941, for which work will proceed soon.

RUSHFORD, MINN.—City Council has plans under way for new municipal power plant, for which funds are being arranged. Ealy G. Briggs, 1957 University Avenue, St. Paul, Minn., is consulting engineer.

GRAND COULEE, WASH.—Bureau of Reclamation, Denver, Colo., receives bids until July 24 for three 60-cycle, three-winding, single-phase, oil-immersed, water-cooled, outdoor-type transformers, each with rating of 36,000-kva. at 132, 800/230,000 Y-volts, 36,000-kva. at 66,400/115,000 Y-volts, and 36,000-kva. at 13,600 delta volts, for Unit L-1; and three 60-cycle, two-winding, single phase, oil-immersed, water-cooled, outdoor-type transformers, each with rating of 36,000-kva. at 13,600 delta volts to 66,400/115,000 Y-volts, for Unit L-2, Grand Coulee power plant, Grand Coulee, Columbia Basin project, Wash. All equipment will be installed by Government (Specifications 921). Also, until July 23, for 150-ton capacity gantry crane, with auxiliary trolley of 27 tons.

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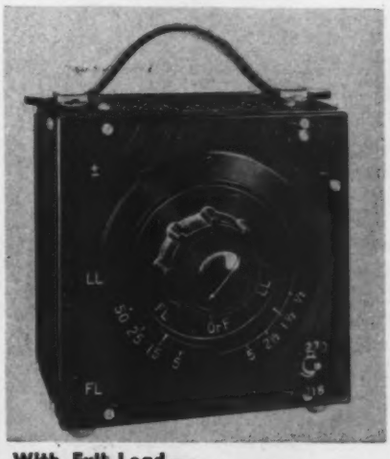

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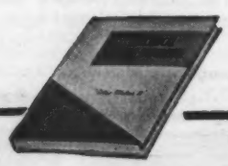

*** These companies have supplied additional buying information on their products in the 1940 edition of the Electrical Buyers' Reference, published by Electrical World**